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COVER

Field Museum paleontologists at camp in northwestern Colorado. Assistant curator Elmer S. Riggs (left) and geology preparator H. W. Menke (center, washing cooking utensils) are on their way to discover the remains of *Brachiosaurus,* which was to be recognized as the largest of all dinosaurs. Black tent by wagon is photographer's dark room. See story, p. 3.

Photos

Pages 9, 12 (top), D. Walsten; 12 (bottom), M. Jacobs; 16, 18 (top, bottom) D. Walsten.

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BRACHIOSAURUS

the biggest dinosaur of them all

by David Young

"Riggs Hill?" asked the nice little lady in purple-flowered dress sitting behind the reception desk in the Grand Junction, Colorado, museum. "Does he work here?"

"No, Madame," I replied. "Riggs Hill is a place."

The receptionist looked somewhat nonplussed and shuffled through some official-looking rosters to gain a second to think. "I've never heard of it," she said finally. "Where is it?"

"That's what I want to know," I replied.

"What is it?"

"They dug up the *Brachiosaurus* there a long time ago."

"A what?"

"A dinosaur."

"Oh," she said with a smile of recognition. "Then you'll have to talk to the paleontologist."

The paleontologist, a young former Harvard University fossil preparator named Lance Erikson, was at that moment lecturing a group of visiting school children on the lifestyle of a thirty-foot ➤

At right, H. W. Menke, geology preparator at Field Museum from about 1898 to 1904, poses with the 675-pound femur of Brachiosaurus. *Date of photo about 1901. Several months earlier Menke had assisted in excavating the fossil from its bed in the Grand River Valley of northwestern Colorado.*

David Young is a reporter for the Chicago Tribune

dinosaur mounted behind him. Yes, he knew where Riggs Hill was located; and, yes, he would take me there.

"You know," Erikson said, "that's where they found the *Brachiosaurus*."

A thousand miles to the east of Grand Junction stands Chicago's Field Museum —an imposing neoclassical structure which has a main exhibition hall (Stanley Field Hall) large enough to hold the entire Grand Junction museum.

"Brachiosaurus?" said John Bolt, Field Museum's assistant curator of fossil reptiles and amphibians, as he led me to a ground floor storage room where the creature's bones were hidden from public view. "It's right here!"

And it was; there in the dimly lighted temporary storage room reposed the mortal remains of mosasaurs, mastodons, and fossil mammals, many still encased in the protective plaster jackets placed on them years ago as they were dug from the rocks. Among them were the bones of the *Brachiosaurus* taken from Riggs Hill in 1900.

Such is the fate of poor *Brachiosaurus*. He was the largest animal known to have walked the face of the earth, and one of the most anonymous.

Many of the thousands of visitors who each day pour through Field Museum stop to marvel at the huge *Brontosaurus* mounted on the second floor in Hall 38. It is the epitome of the dinosaurs, the "Thunder Lizard," the behemoth of behemoths, the creature in the old Sinclair Oil advertisements, and the monster which chased the heroes through the swamp after King Kong abducted the maiden.

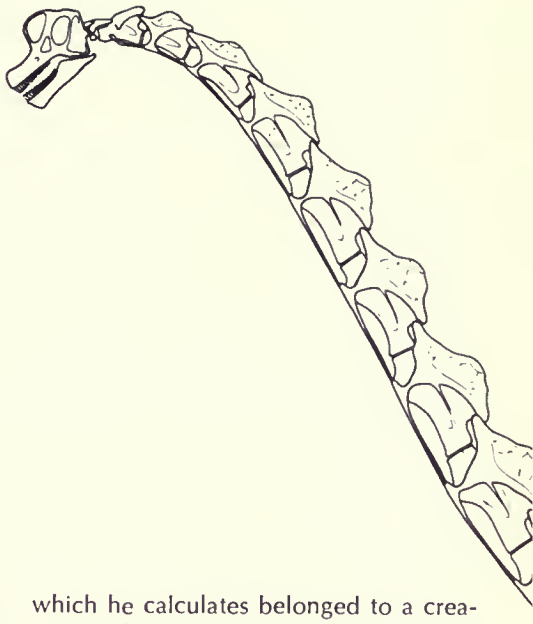
Brachiosaurus *restoration (from Abel).*

But unknown to those visitors who stand and gape at *Brontosaurus* (which by an error in classification is not really *Brontosaurus* but *Apatosaurus*),[1] that ground-floor storage room hides the bones of a creature even larger. They belong to *Brachiosaurus*.

Admittedly, the creature's bones are not much to look at—a total of less than twenty, including seven presacral and two caudal vertebrae, a sacrum, four ribs, a right coracoid, part of the pelvis, a humerus, and a femur. There are not even enough of them to be reassembled into an exhibit. But the dimensions of the *Brachiosaurus* as told by those bones are staggering.

For example, Ziggy, the huge Indian elephant in Brookfield Zoo, weighs approximately seven tons. The weight of *Brontosaurus* in life has been calculated at thirty to thirty-five tons. A *Brachiosaurus* has been calculated to weigh more than twice that—in the flesh![2]

A healthy adult giraffe, the tallest living animal, stands seventeen feet high. The only mounted *Brachiosaurus* skeleton in existence, in the Berlin Museum, stands forty feet tall. But Brigham Young University paleontologist James A. Jensen recently discovered near Grand Junction, Colorado, nine cervical vertebrae which he calculates belonged to a creature with a neck forty feet long. It is too early to tell, however, whether Jensen's sauropod (the family of long-necked dinosaurs that includes *Brontosaurus, Brachiosaurus,* and *Diplodocus*) is a *Brachiosaurus* or an entirely new genus.



So why is the *Brontosaurus* so well known and the gigantic *Brachiosaurus* so anonymous? For the answer, it is necessary to go back nearly a century to America's Wild West—of all places.

In 1877, Chicago was still rebuilding from its famous fire of six years earlier, and the major topic of conversation was still the Sioux Indian War in which Col.

1. Marsh in 1879 named *Brontosaurus* from some bones found at Como Bluff, Wyo., but the bones later turned out to be from a genus previously named *Apatosaurus*. Even though in error, the name *Brontosaurus,* which means "thunder lizard," caught the public imagination and has been popularly used ever since.

2. Edwin H. Colbert of the American Museum of Natural History in 1962 calculated the weight of 14 different dinosaurs based on body volume and specific gravity. He estimated *Brontosaurus'* weight at a maximum of 35.8 tons; but *Brachiosaurus,* according to his calculations, tipped the scales at an amazing 85.63 tons. *(American Museum Novitates,* No. 2076, 1972.)

Drawing of the reconstructed Brachiosaurus ► *in the Berlin Museum. The only complete reconstruction of this dinosaur, it stands 40 feet high. The skeleton was excavated by German paleontologists in Tendaguru, in present-day Tanzania, during a four-year expedition that ended in 1912. For comparison, H. W. Menke is shown with the Field Museum femur. At 214 cm. long, the femur of the Tendaguru* Brachiosaurus *is 11 cm. (about 4.3 inches) longer than that of the Colorado* Brachiosaurus.

George Armstrong Custer and his command had been massacred the year before at the Little Bighorn.

From Como Bluff, Wyoming, an obscure way station along the new Union Pacific Railroad, a couple of railroad employees wrote a letter to a wealthy eastern scientist, telling him of some large bones which they had seen weathering out of the nearby bluffs. The scientist, Othniel Charles Marsh, was interested. He was already engaged in a bitter scientific rivalry with another eastern scientist of considerable means, Edward Drinker Cope.

An assistant sent by Marsh to Wyoming to investigate wrote back that the railroad employees were not lying; there were dinosaur bones "everywhere." Thus began a scientific war between Marsh and Cope that resulted in a pitched battle to see who would dig at Como Bluff.

What the rival scientists dug out of those remote quarries was literally tons of bones, many belonging to a species of sauropod dinosaur which Marsh in 1879 named *Brontosaurus*.

As the exploits of Marsh and Cope and the discoveries of those dinosaurs appeared in the press, the name *Brontosaurus* captured the public imagination. Before the century had ended, other scientists and museums entered the great dinosaur hunt. An expedition from the American Museum of Natural History in New York discovered a shepherd's cabin near Medicine Bow, Wyoming, made entirely from dinosaur bones. The quarry there ultimately yielded a *Brontosaurus* skeleton which now resides in that museum.

And steel millionaire Andrew Carnegie financed an expedition to Split Mountain, Utah, which discovered a rich digging ground that produced more tons of sauropod bones for his new museum in Pittsburgh. The site of those diggings is now Dinosaur National Monument.

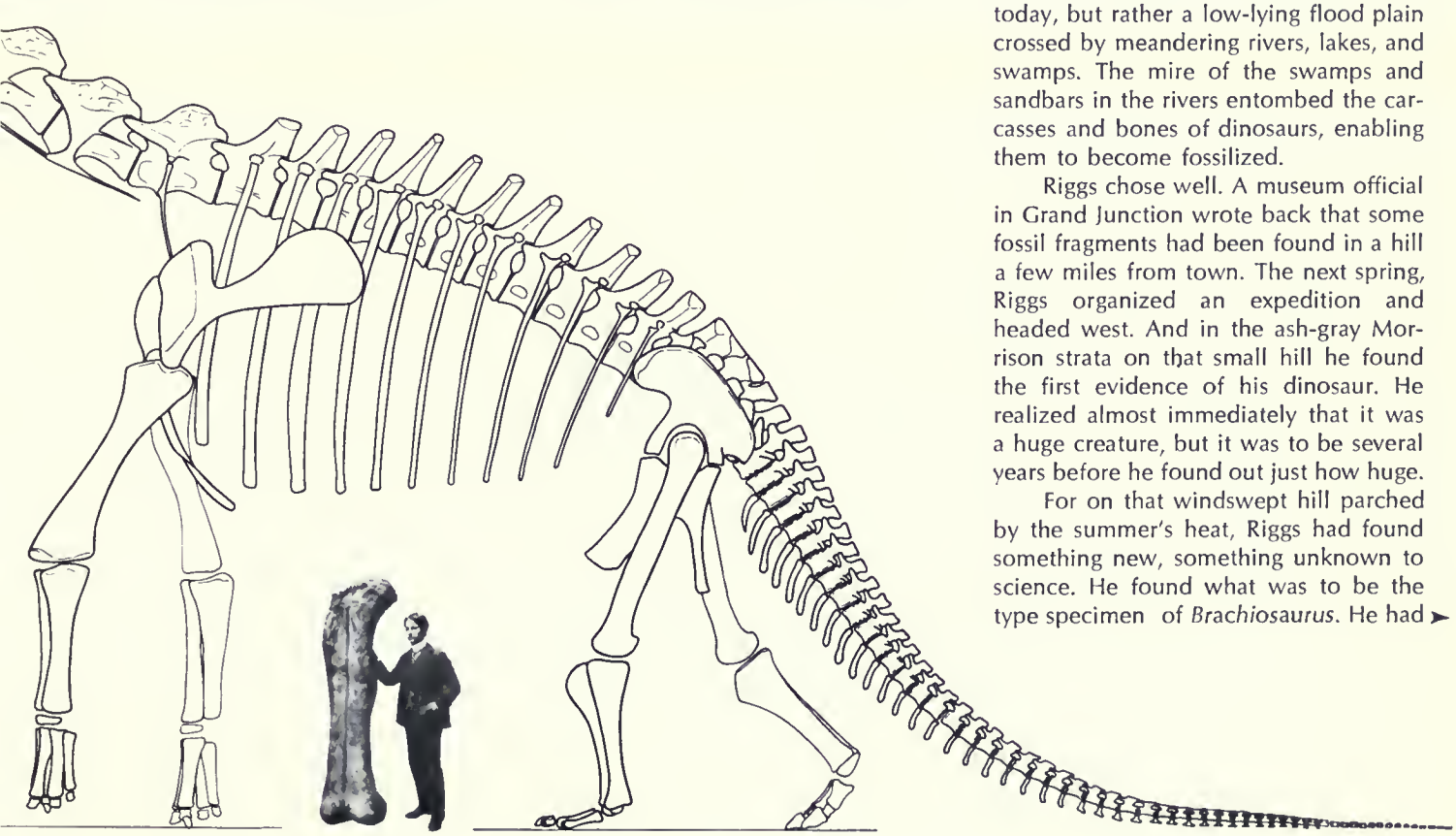
The Field Museum, founded in 1893, somewhat belatedly joined the race for the dinosaurs. Paleontologist Elmer S. Riggs explained it to an interviewer just before his retirement in 1942:

"New departments were being formed in other museums on the strength of new interest in these gigantic reptiles. The name dinosaur was for the first time becoming a household word. The American press was quick to herald throughout the country reports of each new discovery," he said.

Chicago didn't have a *Brontosaurus*, so Riggs wrote persons in several towns along the Denver & Rio Grande Railroad asking if any fossil bones had been found nearby. He chose the area traversed by that railroad because it bisected what is known geologically as the Morrison Formation—a massive deposit covering large portions of Colorado, Wyoming, and Utah. The formation, which is probably the richest dinosaur-fossil digging ground in the world, was laid down some 140 million years ago at the end of the Jurassic geological period. At that time the western part of the continent was not the mountainous region it is today, but rather a low-lying flood plain crossed by meandering rivers, lakes, and swamps. The mire of the swamps and sandbars in the rivers entombed the carcasses and bones of dinosaurs, enabling them to become fossilized.

Riggs chose well. A museum official in Grand Junction wrote back that some fossil fragments had been found in a hill a few miles from town. The next spring, Riggs organized an expedition and headed west. And in the ash-gray Morrison strata on that small hill he found the first evidence of his dinosaur. He realized almost immediately that it was a huge creature, but it was to be several years before he found out just how huge.

For on that windswept hill parched by the summer's heat, Riggs had found something new, something unknown to science. He found what was to be the type specimen of *Brachiosaurus*. He had ➤



Above: Fording streams is all in a day's work for Elmer Riggs and assistants as they make their way to the fossil beds. Left: Expedition assistant poses with the Brachiosaurus *humerus, which at 204 cm., was 1 cm. longer than the femur. Below: Preparator Menke coats the* Brachiosaurus *bones with protective plaster prior to the long haul back to Chicago. Page 7, top: Menke, with clay pipe, and Riggs take a break from bone-digging and enjoy the comforts of life. Hanging from the ridge-pole are partly eaten haunches of antelope, shot by an expedition member. Page 7, bottom: Back at the Museum, Menke and Riggs work on bones collected during the trip. The femur, behind Menke, is still encased in its plaster jacket.*

also found what is still the largest creature known to have walked the earth.

Although Riggs realized at Grand Junction that he had uncovered an exceptionally large sauropod—not the *Brontosaurus* he had been looking for—it wasn't until he got the bones back to Chicago and free from the rocky matrix that he realized its true proportions.

It was the upper leg bones which impressed Riggs the most. The humerus (upper foreleg) of the animal was, at 2.04 meters (about six feet, eight inches), actually larger than the 2.03-meter femur (upper hind leg)—an unheard-of characteristic in sauroped dinosaurs. Most sauropods, like *Brontosaurus,* have a back which reaches its highest point at the hips, then slopes downward to the shoulders. But *Brachiosaurus,* much like a modern giraffe, was taller at the shoulder.

Could there have been a mistake? He rechecked the bones and finally concluded he had found a new animal. He named it *Brachiosaurus altithorax,*[3] and in 1903 published his findings in the *American Journal of Science.* Among his conclusions:

"The length of the humerus and femur, together with the immense size of the thorax, at once establishes the fact that this is the largest and longest limbed of all known land animals."

3. Pronounced *brack-ee-o-sawrus.* The name derives from the Greek *brachion* ("arm") and *sauros* ("lizard").

But with approximately twenty bones to work with, Riggs was unable to determine exactly what the creature must have looked like in life, except to assume it must have looked something like the rest of the more famous sauropods.

Brachiosaurus is, after all, a very close relative of *Brontosaurus,* and both are sometimes placed in the same family.

Since it is almost impossible to whip up public enthusiasm for a few large bones with the tongue-twisting name *Brachiosaurus altithorax, Brontosaurus* remained, as it is today, the most famous of the dinosaurs—more than any other the symbol of those great reptiles which once ruled the earth.

In fact, *Brachiosaurus* remained something of a mystery until a decade later when a German expedition discovered a fairly complete skeleton in the Tendaguru fossil beds of East Africa, now Tanzania—the skeleton, forty feet tall, now stands in the Berlin Museum. Since then, various fragmentary remains identified as *Brachiosaurus* have been found in Europe, Africa, and the western United States. ➤

Today, paleontologists have a fairly good idea of what the creature looked like in life. It had the long neck of a giraffe, only more massive; the bulky body and pillar-like legs of an elephant; a tail relatively shorter than most of its sauropod cousins; and perched atop that long neck was a comparatively tiny head containing a brain no larger than a man's fist, nostrils elevated in a crest on top of the head, and a set of weak, peg-like teeth.

But if paleontologists agree on what *Brachiosaurus* looked like, they have been unable to agree entirely on a number of other puzzling aspects of the beast. Paleontology is a science which reconstructs the past using whatever evidence is available. The men who study dinosaurs must by necessity rely heavily on the bones of the creatures they find buried in rock. Bones can tell a paleontologist much about an extinct creature—how he looked and walked, for example—but they reveal little about such things as internal organs, skin, and physiology. Other fossils found in the same strata can give paleontologists a good idea of the other animals and plant life (the flora and fauna) inhabiting the world at the time and even the environment in which the beast lived. Even animals living today can give some clues as to the lifestyle of their extinct ancestors (the dinosaurs' closest living relatives are the crocodilians), and living animals occupying similar niches in the contemporary environment as creatures long dead can provide further insights. Elephants and sauropods are often compared because they represent the largest herbivores living in their respective times.

Despite all this, many questions remain regarding the way of life of *Brachiosaurus* and other sauropods.

The small mouth and weak teeth of *Brachiosaurus,* for example, immediately raise the question of how so large an animal could eat enough to stay alive. Obviously, the small mouth was a problem to everyone but *Brachiosaurus,* for it lived and flourished for millions of years over large parts of the globe.

One theory is that because the sauropods were reptiles, their metabolic rates and energy requirements may have been less than those of living mammals and they did not require as much food per unit of body weight.[4]

Another is that the sauropods were forced to eat almost continuously to stay alive and grow to such size.

What they ate is still another problem. Some paleontologists believe that the sauropods lived on some sort of soft water plants which would present no problems to their teeth,[5] but James Jensen thinks that *Brachiosaurus* browsed on the tops of trees.[6]

The very size of the *Brachiosaurus* has also caused some academic consternation. For many years, many paleontologists argued that the weight limit for a four-legged animal (tetrapod) was about fifty tons. They reasoned that bone, ligament, and muscle simply could not support a land animal any larger.

But in 1962, Edwin H. Colbert of the American Museum of Natural History in New York calculated the weight of *Brachiosaurus,* based on body volume

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4. W. E. Swinton, *The Dinosaurs,* John Wiley & Sons, 1970, p. 192.
5. Bjorn Kurten, *The Age of the Dinosaurs,* McGraw-Hill Book Co., 1968, pp. 92-93. See also Colbert, op. cit., p. 12. There are a number of pitfalls in speculating on the diet of dinosaurs. As Kurten points out (pp. 112-13), the diet of duck-billed dinosaurs, *Hadrosaurs,* was assumed to be aquatic plants because the animals' skeletal structure indicated a semi-aquatic life. In 1922, however, a German paleontologist published a list of the stomach contents found preserved in a *Hadrosaur* fossil, showing that the animal ate conifer needles, twigs, seeds, and fruits from land plants. See also John H. Ostrom, "A Reconsideration of the Paleoecology of Hadrosaurian Dinosaurs," *American Journal of Science,* 1964, Vol. 262, pp. 975-97.
6. Interview with Jensen author, May, 1974.

Brontosaurus *(more properly* Apatosaurus*) restoration, a mural, by Charles R. Knight. The 25-foot painting, with 28 other Knight murals of prehistoric life, is on view in Field Museum's Hall 38. Directly opposite the mural is a 15-foot high reconstruction of* a Brontosaurus *skeleton, discovered by Elmer Riggs near Grand Junction, Colo., in 1901.*

and specific gravity, at more than 85 tons.[7] Colbert argued that *Brachiosaurus* must, therefore, have been a semiaquatic creature living in swamps or lakes where the water could help support its massive body.[8] After all, the whales, the only animals ever to exceed *Brachiosaurus* in size, spend all of their lives in water. *Brachiosaurus'* long neck and nostrils elevated above its head, many paleontologists argue, are characteristics which would enable it to wade along the lake and swamp bottoms with its head still above water.

Colbert has often painted the sauropods as sluggish swamp-dwellers living in steaming jungles where they could feed on aquatic plants with little to fear from predaceous dinosaurs ashore.

Such a life would mean that the giants would have to go ashore infrequently perhaps only to lay their eggs and migrate to new feeding grounds.

However, a number of paleontologists believe that *Brachiosaurus* spent most of its life on land, feeding from the tops of trees in the same way a giraffe does today. Why else would the animal reach such a great height? These paleontologists claim that the structure of the creature's vertebral column indicates, *Brachiosaurus* could not easily lower its head for ground feeding.

Jensen, one of the proponents of this view, believes that *Brachiosaurus* lived on gently rolling uplands not far from the flood plains inhabited by semiaquatic sauropods like *Brontosaurus*. Since upland environments are not conducive to fossilization, this would explain the relative scarcity of *Brachiosaurus* fossils, Jensen reasons.[9]

Its great size would protect it from the predators of the time. Some of these creatures were awesome in their own right. *Antrodemus (Allosaurus)*[10] was a thirty-foot reptile with a gaping mouth armed with serrated teeth. But Colbert calculated that *Antrodemus* weighed only about two tons. For one of them to bring down a full-grown *Brachiosaurus* would be roughly equivalent to a lion killing a six-ton elephant. Modern carnivores—even the crocodile—generally do not attack prey considerably larger than themselves. In other words, their prey must be manageable. If *Antrodemus* ate *Brachiosaurus*, it may have confined itself to younger animals which had not yet grown to such great size.

Ironically, Riggs was one of the early proponents of the theory that *Brachiosaurus* was a land dweller—a theory which he argued in several scientific papers in the early 1900s.[11] He also argued that the feet and limbs of all sauropods indicated the entire group was terrestrial:

". . . but the length and slenderness of the limb, the deep thorax, and broad sacrum, the expanded ilium, and the abbreviated tail of *Brachiosaurus* all point to a great agility and much better adaptation to terrestrial habits than is found in any other representative of the sauropods."

Unfortunately, Riggs' observations were based on a single incomplete *Brachiosaurus* skeleton a decade before the German discoveries in Africa. And his arguments failed to sway paleontologist W. E. Swinton:

"From this view there seems little good evidence to counter the overwhelming array of adaptations for a water habitat."[12]

Whatever its lifestyle, *Brachiosaurus* apparently became extinct around the close of the Jurassic about 140 million years ago. While other types of dinosaurs, even some sauropods, survived the Jurassic and lived on into the Cretaceous, there is no evidence that *Brachiosaurus* was among them. Of course, all dinosaurs are believed to have become extinct 65 million years later at the end of the Cretaceous.[13]

Why did *Brachiosaurus* disappear so much sooner than its dinosaurian relatives? There has been a veritable host of reasons given for why the dinosaurs became extinct—everything from cosmic disturbances to racial old age. Whatever the causes of the extinction of such well known dinosaurs as *Tyrannosaurus* and *Triceratops* about 70 million years ago, *Brachiosaurus* was dead and fossilizing long before they even evolved.

The most common explanation for the extinction of *Brachiosaurus* (and other sauropods) is that its environment changed and it was unable to adapt to a new one. Possibly the low-lying plains on which it lived rose slowly during the late Jurassic and early Cretaceous, draining the swamps and lakes, changing the course of rivers, and altering the environment upon which the huge creature was dependent. There is no way to know for sure.

So the *Brachiosaurus* remains a puzzle, as much so in life as in death—tons of massive bones to titillate the public imagination as well as scientific curiosity. In some ways, we are no closer to solving the riddle of the giant among the dinosaurs than when Chicagoan Elmer S. Riggs first discovered its existence on that lonely hillside in Colorado seventy-five years ago. □

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7. Colbert, op cit.
8. Interview with Colbert by the author in June, 1974. See also Colbert, *Dinosaurs: Their Discovery and Their World*, pp. 91-105; and *The Dinosaur Book*, McGraw Hill Book Co., 1945, pp. 94-95. Further discussion of the semiaquatic theory is in Alfred S. Romer's *Vertebrate Paleontology*, 3d ed., University of Chicago Press, 1966, pp. 153-56.
9. Jensen interview; see 6, above.
10. *Antrodemus* is popularly, but erroneously, known as *Allosaurus* from *Allosaurus fragilis* in 1877. See Swinton, op. cit., pp. 147-49.
11. Elmer S. Riggs, "The Dinosaur Beds of the Grand River Valley of Colorado," *Field Columbian Museum Publication #60*, Geological Series, Vol. 1, No. 9, 1901, pp. 267-74; and "Structure and Relationship of Opisthocoelian Dinosaurs," *Field Columbian Museum Publication #94*, Geological Series, Vol. II, No. 6, 1904, pp. 229-47.
12. Swinton, op. cit., p. 188.
13. *Brachiosaurus* may have survived into the Cretaceous period. However, there is a scarcity of lower Cretaceous fossil strata in the United States and no evidence of *Brachiosaurus* in later deposits. John Bolt, Field Museum assistant curator of fossil reptiles and amphibians, points out that there may be a similarity in the problem of dinosaur extinction at the end of the Cretaceous: that some dinosaurs may have survived into the Cenozoic. No proof of this has yet been published.

our environment

Electric Power from Waves

Man's utilization of moving water as an energy source has until now been confined to rivers and streams, but imaginative engineers have long dreamed of harnessing the enormous energy present in ocean waves and tides.

The work of a thirty-five-year-old University of Edinburgh scientist, Stephen Salter, suggests that Britain could, indeed, be deriving much of its electric power from ocean waves by 1985 or 1990. The British Department of Trade and Industry has been sufficiently impressed with Salter's work to grant him $140,000 for further development of his project.

Salter's studies indicate that the most promising location for the first wave-catching generator is off Scotland's northwest coast, about ten miles west of the Hebrides. The floating generator would be somewhat larger than a supertanker and constructed of concrete and steel. Twenty to forty vanes, rotated by the waves, would turn the generator, thus producing electricity. All of Europe's electrical needs, says Salter, could be provided by such generators placed at 100-mile intervals along Europe's coast.

Harming Eagles Is Serious Crime

The killing, or even the harassment, of bald eagles is viewed by the federal government as a serious offense—serious enough to earn the offender one year in prison and a fine of $5,000. The Bald Eagle Protection Act, amended in 1962 to include protection for the golden eagle, provides for fines up to $10,000 and two years' imprisonment for second offenders.

The act also provides that persons who give information leading to conviction of offenders may receive one-half of any fine, but not exceeding $2,500. Individuals with information which might lead to conviction of a violation of the act should contact the nearest state conservation officer or U.S. Agent.

Each fall, dozens of eagles are shot and killed or crippled by hunters who fail to exercise the responsibility that goes with carrying a gun. To make matters worse, many eagles are caught in steel traps, electrocuted on power lines, and poisoned intentionally or through pesticide pollution.

To avoid the accidental trapping of eagles, animal trappers should make their sets in ways that obscure visibility from the air. While hunting, eagles rely mainly on their keen sight. If birds can't see the bait, they won't be attracted to traps. Birds of prey are most often caught in exposed upland sets for foxes or raccoons that are baited with animal carcasses. Many accidents could be avoided by using scents, by burying baits, or by setting traps in areas of reduced overhead visibility: under overhanging banks, rock outcrops, or stumps.

Each year, the U.S. Fish and Wildlife Service, along with other federal or state agencies, universities, and private organizations, conducts a bald eagle nest survey to measure reproductive success. According to some wildlife biologists, these eagles should reproduce an average of about .67 young per adult pair each year to maintain numbers and ensure survival of the species. Reported nesting success in 1974 ranged from .33 to .94 in the Great Lakes states. Although annual ups and downs are expected—and it may take years to see trends clearly—generally low production has been documented in breeding areas adjacent to the Great Lakes, while production figures from inland areas indicate a stable population. Low production in the Great Lakes area is generally attributed to the concentration of chlorinated hydrocarbon pesticides, such as DDT, in fish eaten by the eagles.

NRA Opposes Steel Shotgun Ammo

In the November, 1974, *Bulletin* (p. 8), the field-testing of steel shotgun ammunition by the U.S. Fish and Wildlife Service was reported. The new ammunition was proposed by the federal agency as a possible alternative to lead pellets, which have been responsible for the death—by lead poisoning—of tens of thousands of ducks and geese each year. The National Rifle Association, however, has now gone on record against the use of steel, charging that the agency's environmental statement on the new ammunition is not supported by reliable, probative, or substantial evidence.

Moose Shot in Iowa

A Gilman, Iowa, farmer was charged recently with illegal possession of a protected animal, after a rack of moose horns, frozen meat, and a moose hide were discovered on his property. Conservation officers believe that the moose was one that had been observed frequently during the past year along the Minnesota-Iowa border. "We had only one moose in Iowa," remarked state conservation official Mike Runyan, "now we don't have any."

Riper Squash from Warmer Soil

Industrial waste heat may be beneficial in farm crop cultivation, according to a five-year study conducted by the Eugene, Oregon, Water and Electric Board. The project was partly funded by the Environmental Protection Agency. It was conducted on 170 acres of land supporting orchards and row crops.

Thermal water ranging from 80 to 100 degrees Fahrenheit was pumped from a pulp and paper mill on the MacKenzie River, about 2.5 miles from the project site. The warm water was used for research on frost protection, undersoil heating, greenhouse applications, cooling of crop plants, humidity control irrigation, and production of two crops per year.

"Results of the study," reports Norbert A. Jaworski, project director, "indicate that the greatest potential agricultural uses of waste heat are in the area of underground soil heating."

Tomatoes, sweetcorn, asparagus, rhododendrons, cantaloupes, and squash all grew faster with soil heating. There was no significant change in the level of mold and bacteria.

Native Wolf Shot in Michigan

The first reported shooting of a native timber wolf in Michigan since the mid-1960s occurred in November. The news was a surprise to Michigan Department of Natural Resources biologists, who believed that native wolves had long since disappeared from their state. The wolf was shot about 30 miles north of Menominee, in the Upper Peninsula. The hunter who killed the 76-pound male wolf had mistaken it for a large coyote, and immediately reported the incident to conservation officials. The timber wolf is protected under the 1973 Endangered Species Act, and a heavy penalty may be imposed for killing the animal. The coyote is not so protected. Since the killing was apparently inadvertent, no charges were filed against the hunter. The wolf was missing two toes, suggesting that it had once been caught in a trap, and several teeth were broken.

Early in 1974, two male wolves and two females that had been caught in northern Minnesota were released near the Huron Mountains in the Upper Peninsula in an attempt to restore the species to that area. Both males and one female were subsequently killed, however, so only a female remained of the original foursome. (See July/August *Bulletin*, p. 15.)

Publication cost of this section on Our Environment has been underwritten, in part, by the Ray A. Kroc Environmental Education Fund.

Polluted Fish Taste that Way

If you want to catch fish that are most suitable to the palate, do your angling in clear, unpolluted waters. That is the advice of food scientists at the University of Wisconsin-Madison. H. E. Calbert, S. E. Dunnick, and R. C. Lindsay report that industrial wastes entering a stream in north central Wisconsin created unpleasant flavors in walleyes. Fish caught above the discharge points had no detectable off-flavors, but those caught downstream of the discharge were noticeably affected by pollutants.

"Petroleum-like and chemical flavors are the predominant ones identified," reported the researchers. Metallic and "earthy" flavors were also noted. Fish size made no apparent effect on flavor or acceptibility ratings, but older fish had more pronounced flavors.

"The next step," said Calbert, Dunnick, and Lindsay, "is to identify the flavor-causing agents so that water quality improvement programs can be set up to remove the compounds that cause the off-flavors."

Minnesota's Natural Iron Ore Nears Depletion

The mining of Minnesota's natural iron ore will all be over in another five to eight years, says Minnesota state revenue commissioner Arthur Roemer. Currently about 18 million tons of natural ore are being mined annually; geologists estimate that about 85 million tons remain.

Natural ore is so-called because it can often be shipped directly to steel mills in its natural state. Low grade ore such as taconite, on the other hand, must be substantially refined before shipment.

"At the present rate of mining," says Roemer, "iron ore will be gone in five years." He added that increased production of taconite will probably mean a reduction in the amount of natural ore that is mined, thus extending the supply to eight years or so. Since the Minnesota ore deposits were first mined in 1884, about 2.7 billion tons of natural ore have been extracted.

Two decades ago the Minnesota mines were producing about 22 percent of the world's iron ore total; today they produce less than 7 percent. This is the consequence of new ore deposits being discovered, and of production costs being lowered in other states—notably Wisconsin, Michigan, Missouri, Pennsylvania, and Wyoming—and in other regions of the world. Iron ore production has increased in Australia, Brazil, India, Liberia, Peru, Venezuela, as well as in Quebec and Labrador.

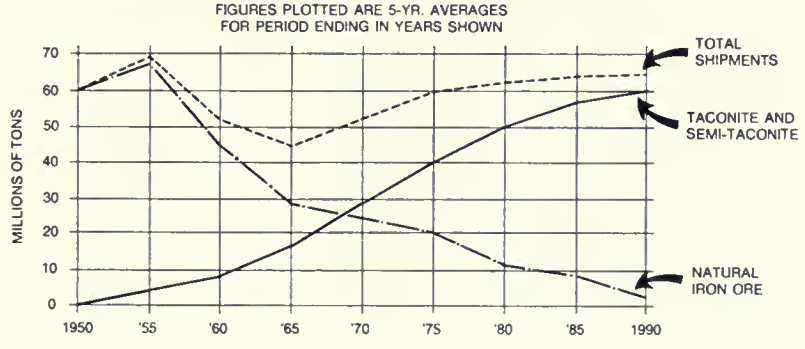
Taconite production in Minnesota during 1973 was over 40,000,000 tons—more than double the 1964 production. Engineers estimate that annual production of this low grade ore will eventually peak at about 65,000,000 tons.

DDT—Containing Drug Registered for Medical Use

Topocide, a pesticide product containing DDT, has been registered by the Environmental Protection Agency for use against human crab lice, scabies, and head lice. The EPA order of June, 1972, specified that those uses of DDT intended for public health disease control, health quarantine, and prescription drugs were essential and did not present an unreasonable risk to health or the environment.

RECENT AND PROJECTED FUTURE SHIPMENTS OF IRON ORE FROM MINNESOTA

FIGURES PLOTTED ARE 5-YR. AVERAGES FOR PERIOD ENDING IN YEARS SHOWN



The above graph was charted by The Iron Mining Industry of Minnesota, an association of Minnesota's ten largest iron producers. It varies sfightly from The Minnesota revenue department's current and projected production figures for natural ore.

Our Thanks to EPA

No one can say that the Environmental Protection Agency (EPA) has not been active as watchdog of our environment. Since the agency was formed in December, 1970, it has taken more than 4,000 enforcement actions against violators of water, air, and pesticide laws.

Among the more significant EPA rulings enforced since 1973 are the following:

- The first large-scale vehicle recall (against Chrysler Corporation: 825,000 autos, 1,000 trucks).
- The first criminal fine levied in an auto emissions tampering case.
- The first enforcement actions under Ocean Dumping Act.
- Initiated EPA-administered pesticide civil case program (336 cases to March 1974, involving civil penalties of $690,155.)
- Requested court action against major polluters in Washington, D.C. area (major cleanup agreement reached).
- Began full implementation of pesticides "stop sale, use, or removal" program.
- Provided massive legal support crucial to major pesticide cancellation proceedings (DDT, Aldrin/Dieldrin).
- In cooperation with state agencies, identified and investigated major air pollutant emission sources—18,000 to 20,000 of which account for 85 percent of stationary air pollutant sources in the country (15,000 major emitters identified and investigated).
- Obtained federal district court injunction against Reserve Mining Company, the largest polluter of Lake Superior.
- Obtained registration of 3,500 pesticide-producing establishments nationwide and inspected most of them.
- Initiated more than 2,000 enforcement actions on pesticides through March, 1974, including 680 warning notices, stop sale, use, or removal orders, detained misbranded, ineffective, or otherwise unlawful import shipments in 149 cases, requested formal recall of products in 38 instances. Criminal prosecution was requested in 226 cases.
- Following EPA's April 1974 suspension of pesticide products containing vinyl chloride, formal recalls requested by EPA's pesticide enforcement division, with subsequent removal of more than 50,000 units containing vinyl chloride—covering a wide variety of products—from the market.
- Initiated 567 enforcement actions, including 440 oil-spill cases. Criminal fines and civil penalties resulting from these prosecutions total more than $165,000.

field briefs

Stanley Roseman

John White

Museum Animals Make Good Models

Stanley Roseman (left), a New York City artist whose commissions have included portraits of composer Virgil Thompson and stage luminaries Helen Hayes and Ethel Merman, has discovered a new realm of portraiture at Field Museum. He recently spent several days at the Museum doing oil paintings and sketches of animals. Here Roseman is working on a study of a Marco Polo's sheep *(Ovis poli)* in Hall 17. Normally he has to contend with the restlessness of human subjects, so it was a pleasant change, he remarked, to work from such patient, cooperative models.

Roseman is one of a great many artists—student and professional—who have experienced the unique opportunity of drawing, painting, or sculpting the Museum's life-like exhibits.

Indian Crafts Techniques

John White, coordinator of Field Museum's Native American Program, demonstrates Eastern and Southeastern Woodland Indian crafts techniques, on the Museum's main floor, on Fridays until June. At left, below, he demonstrates pottery techniques that have been handed down in his family from generation to generation.

Museum Staff Notes

Department of Anthropology

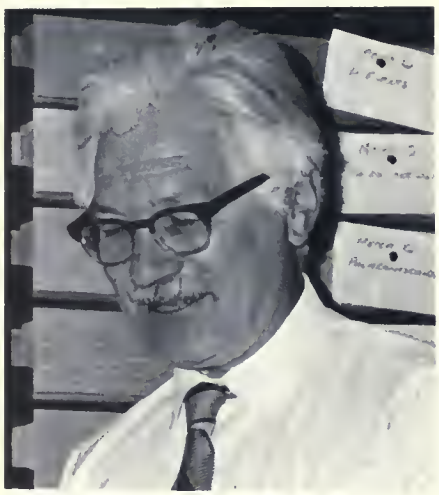
James VanStone completed his term as department chairman on January 1, and has resumed his position as curator, North American archaeology and ethnology. Phillip Lewis, curator of primitive art and Melanesian ethnology, is serving as acting department chairman.

Department of Geology

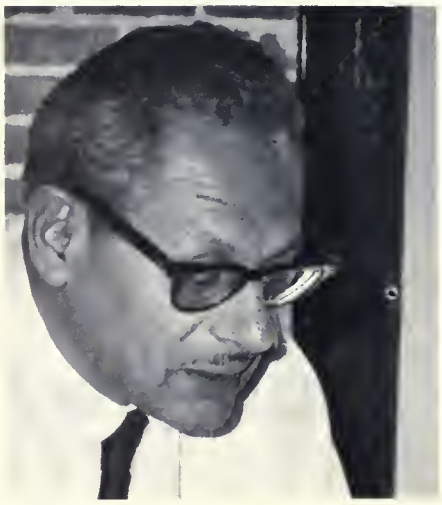
Rainer Zangerl retired as department chairman on December 1. He had served in that post since 1962 and had been with Field Museum since 1945. Zangerl's initial appointment was as curator of fossil reptiles and amphibians. Although retired, Zangerl expects to continue an active research program at the museum. Edward Olsen, curator of mineralogy, is serving as acting chairman.

Department of Zoology

Rupert Wenzel has been appointed to another four-year term as department chair-



Rainer Zangerl



Philip Hershkovitz

John Kethley

man. John Kethley, who joined Field Museum as assistant curator of insects in 1970, has been named head of the Division of Insects. Henry Dybas, who held the post, has resumed his position as curator of insects. Philip Hershkovitz, research curator of mammals since 1962, retired October 31. He had been with the Museum since 1947.

Department of Education

Elizabeth Deis has recently rejoined Field Museum as an instructor in the Raymond Foundation, replacing Julie Castrop, who was appointed assistant to Carolyn Blackmon, coordinator of special education services. Previously, Mrs. Deis had been a Field Museum volunteer and served as an assistant in the Division of Mammals. She is a native of Evanston, received her BA in zoology from Mount Holyoke College and an M.S. from the University of Chicago.

Lorain Stephens is also back on the Department of Education staff after an absence of several years. She formerly was an instructor in zoology and, at a later time, served as a Raymond Foundation volunteer. Mrs. Stephens' new responsibility is a dual one: coordinator of both the Ray A. Kroc Environmental Education Program and of the Man in His Environment education program.

Huge Coal Age Fossil Collection Donated by Museum Member

An important collection of thousands of coal age fossils taken from strip mines in Will, Grundy, and Kankakee counties has been given to the Museum's Department of Geology by a long-term Museum member, Jerry Herdina of Berwyn.

Herdina, a retired construction engineer for whom geology is a hobby, collected the specimens between 1928 and 1973. Included are fossil insects, spiders, amphibians, shrimps, jellyfish, scorpions, and many others. *Herdina ovalis* (a small, short-winged insect) and *Paleocadmus herdinae* (a cephalopod) have been named for Herdina.

Strotz Named Trustee

The newest member of Field Museum's Board of Trustees is Robert H. Strotz, president of Northwestern University since 1970. His appointment became effective November 18.

Dr. Strotz joined the Northwestern faculty in 1947 as an instructor in economics. In

Robert H. Strotz

1958 he was named professor and in 1966 he became dean of the College of Arts and Sciences, a position he held until being elected president.

Letters

In the May, 1974, *Bulletin,* in the article "Return of the Buffalo" the number of those animals living in North America today is given as "about 45,000," a figure provided the *Bulletin* by the National Buffalo Association. The following letter disputes that figure:

Sirs:

. . . I took a census of living bison in North America in the early 1970s. As of January 1, 1972, there were 30,100. Projecting the increase between Henry H. Collins' census of 1951 which reported 23,154 and my 1972 figures, there were on January first of this year approximately 36,000 buffalo in the U.S. and Canada.

My census is detailed in *The Buffalo Book,* recently published by Swallow Press in Chicago. The book includes a list of all known surveys taken from 1888 to present day.

David Dary
Lawrence, Kansas

Mr. Dary's 374-page study of the buffalo, published in August, 1974, is the definitive work on the subject.—Ed.

Herman F. Strecker in his study, Reading, Pennsylvania, about 1895. Behind him are insect storage cabinets.

The Sculptor Who Collected Butterflies

by David M. Walsten

Sculptor by day, lepidopterist by night, Herman F. Strecker is unique in the history of science. By the time he died in 1901 at the age of 65, Strecker had assembled, catalogued, and recorded —in his "free" time—one of the largest and most important collections of macrolepidoptera* in the world; in the New World it was unsurpassed. In 1908 Field Museum acquired this superb collection —50,172 specimens—for $15,000. It comprised a jewellike nucleus for the Museum's enormous insect collection, which today numbers several million specimens.

Together with the insects, the Museum also acquired from Strecker's widow a collection of several thousand letters between Strecker and other leading naturalists of the day. Spanning more than four decades, the letters are collectively a valuable document on the state of natural history in the latter half of the nineteenth century. Many of them, sent by collectors in the field, provide historical information on the development of the Old West.

The insect collection is about evenly divided between butterflies and moths; 14,217 species and varieties are represented. It also includes 251 new species that were first described by Strecker and 337 type specimens (individuals on which the initial description of a species, genus, or other taxonomic unit is based). Strecker obtained specimens from all over the world by trade, purchase, and gift. He caught many specimens in the field himself, particularly in eastern

*Macrolepidoptera includes all the butterflies and the majority of moths—excluding only those species with very small wingspread.

The editor wishes to give special thanks to Wayne E. Homan, of Reading, Pa., for photos and background information on Herman Strecker.

United States, in the West Indies, Mexico, and Central America.

Strecker was born in Philadelphia in 1836, the son of a recently emigrated sculptor from Stuttgart, Germany. In 1846 the family moved to Reading, Pennsylvania, where Strecker was to spend the rest of his life. At the age of 11, he became an apprentice in his father's marble works, and later as a sculptor, he created a number of notable monuments that are still to be seen in Reading, among them a soldiers' memorial and a 28-foot-high "Crucifixion" and "Angel of Resurrection."

As a boy, Strecker's interest in natural science was already so intense that he often traveled to view the collections at Philadelphia's academy of arts and sciences. By the time he was 19, his interest had focused on butterflies and moths. In later years Strecker would often catch the train on Saturday nights, after work, travel to Philadelphia or New York, and spend all day Sunday studying works on Lepidoptera in the libraries; early Monday he would return to Reading.

In 1872, Strecker began work on his monumental *Lepidoptera Rhopaloceres and Heteroceres, Indigenous and Exotic,* which he illustrated with fifteen colored plates and hundreds of line drawings. Supplements to the work were issued in 1898, 1899, and 1900. Illustrating the work was a giant project in itself. Strecker saved his money to buy an expensive lithograph stone, painstakingly engraved an illustration on it, then sent the stone to Philadelphia for 300 reproductions to be made. The stone was then returned to Reading. Strecker shaved off the old engraving and drew another, and again sent the stone off to Philadelphia. After six years the book was done. In 1878 Strecker also published a *Synonymical Catalogue of North American Butterflies,* which for years was the standard work on the subject.

In the July, 1890, *The Museum,* Edwin A. Barber described Strecker's remarkable routine:

> By night has been accomplished all the enormous labor and correspondence required to form ➤

Two of Strecker's most ambitious sculptures, "Angel of Resurrection" and "Crucifixion," may still be seen in Reading's Charles Evans Cemetery.

A page from Strecker's Lepidoptera Rhopaloceres and Heteroceres, Indigenous and Exotic, *which he illustrated himself.*

his collection, as well as the writing of his works and drawing and lithographing the numerous plates which illustrate them. It is by rigid systematizing that he has accomplished so much; no time is lost; every minute must count. Arising at 6 a.m., he is at his business an hour later; at 1:30 he dines; from 2 to 6 p.m. again at pencil or chisel; then comes the evening and night hours, which, up to midnight, are devoted to his favorite science; then supper, followed by a pipe or segar, and a half hour's reading of a primer or tract, a newspaper or a novel, or anything else unscientific. He retires at about 12:30, for the night, this having been the routine for over a quarter of a century.

Oddly enough, the Strecker collection remained in the custody of a Reading-area native even after its acquisition by Field Museum. William J. Gerhard, who retired as Field Museum's curator of insects in 1950 and died in 1958, was himself born (1873) and raised near Reading and, like Strecker, spent many days as a youth in the museums of Philadelphia, studying the wonderful collections. Gerhard assumed charge of the then newly created Division of Entomology in 1901. In 1908 he returned to Reading for three months to prepare the Strecker collection for shipment. In *Entomological News,* July, 1909, Gerhard recalled the special care with which the insects were readied for the long train ride to Chicago:

> A large amount of work of a preparatory nature was, of course, necessary before any of the material could be packed. The first step . . . was to number the cabinets and drawers. But much more essential was it to preserve the original arrangement of the specimens in the drawers, . . . it would not have been well to disturb the specimens by transferring them into cotton lined drawers, or to ar-

range them shingle-like, as is frequently done with small lots. . . .

To lessen the possibility of an insect becoming loose and rolling around, while the drawer was being handled, every pin was tested and forced more deeply into the cork or wood, . . . Those insects that were not held firmly were made secure by means of a pin inserted on each side of the body of the insect. When this method was not possible, the desired stability was obtained by placing pins in front of the costal edge of the forewings . . . a few of the very large species were shelved, that is, their wings were supported by strips of cardboard.

On account of the inconvenience of using the narrow stairway leading to the third story room in which the collection was contained, everything was carried to one of the windows and lowered to the ground by means of a block and tackle; . . . 15 bales of excelsior and 139 shipping cases were required for packing the drawers, besides the boxes used for the books and correspondence. The weight of the packed insects was over 14,000 pounds, the books, cabinets, etc., over 5,000 pounds.

On placing the collection in the freight car, . . . the only precaution was to arrange the boxes, right-side-up, in such a way that there could be no lateral motion. To prevent them from shifting backward and forward, heavy braces were fastened to the interior of the car. Since insects, which are classified as stuffed animals, are scheduled at three times the regular first class rate, it is not surprising, perhaps, that the railroad officials were inclined to display some interest in the shipment. ►

William J. Gerhard, a Field Museum curator and emeritus curator for some 57 years, spent three months in Reading preparing the Strecker moths and butterflies for shipment to Chicago. Here, in his later years, he continues to work with the collection.

Mike Prokop, custodian of collections, Division of Insects, holds a drawer of Strecker moths, including the enormous Thysania (Erebus) agrippina, *a noctuid moth of Central and South America. The specimen at top, the largest in the entire Strecker collection, measures 11¾ inches across.*

How needless was the fear or doubt concerning the safe arrival of the collection! Not one of the 800 glass covers was broken; but one insect . . . was loose in all of the drawers. Despite the frequent handling and the 900 mile ride to which the insects were subjected, the only signs to indicate that the collection had ever been moved, were five or six detached bodies and here and there a broken antenna.

For the rest of Gerhard's life, a special project of his was studying and maintaining the Strecker collection. He meticulously transferred each insect from the original Strecker cases to vermin-proof drawers stored in vaultlike steel cabinets. Thanks to the special care always accorded the collection, the fragile specimens appear today as perfect and as brilliant as in life—belying the fact that many were collected over a century ago. Three of the Strecker butterflies, reproduced in color, are to be seen in the appointment calendar section of the December, 1974, *Bulletin*. □

Mike Prokop holds a drawer of gynandromorph tiger swallowtials (Papilio glaucus), *among the rarest and most interesting in the Strecker collection. The male of this species, common in northeastern United States, is normally yellow with black stripes, the female mostly black. These specimens exhibit genetic defects in which a single individual shows characters of both sexes.*

"Ascent of Man"

THIRTEEN REMARKABLE FILMS, produced by Time-Life Inc., and dealing with the history of science, will be shown at Field Museum, in the Lecture Hall, on Fridays and Sundays at 2 p.m., from January 24 through April 20. Each hour-long film is concerned with a specific area of science, including the relationship of the humanities to the sciences throughout history, the effect of political and social developments on scientific discovery, mankind's attempts to understand and alter the natural world, and the benefits and detriments of science.

The films were written and narrated by the late Dr. Jacob Bronowski, a British scientist who, for a decade, was a resident fellow of the Salk Institute for Biological Studies, at La Jolla, California. For British television he wrote and narrated many programs that explore the complexities of science in terms that the average viewer enjoys and understands.

"Among the multitude of animals which scamper, fly, burrow, and swim around us," observed Bronowski, "man is the only one who is not locked into his environment. His imagination, his reason, his emotional subtlety and toughness, make it possible for him not to accept the environment but to change it. And that series of inventions, by which man from age to age has remade his environment, is a different kind of evolution. I call that brilliant sequence of peaks THE ASCENT OF MAN."

Lower Than the Angels (Anatomy and Intellect). Jan. 24, 26. A multitude of evolutionary changes—anatomical and intellectual—gives rise to man's superiority among the animals. New computer techniques illustrate man's evolution, while x-ray and slow-motion photography of an Olympic athlete in action show the complex interweaving of mind and body.

The Harvest of the Seasons (Agriculture). Jan. 31, Feb. 2. Man domesticates plant and animal life. With the Neolithic cultivators come the nomads and the roots of warfare. Cameras capture the unique lifestyle of the Bakhtiari tribe of Central Iran and there recreate the war games of Genghis Khan.

The Grain in the Stone (Architecture). Feb. 7, 9. Man splits a stone and reassembles the pieces to build a wall, a cathedral, a city. From the Greek temples of Paestum and the cathedrals of medieval France to modern Los Angeles, this film expresses man's faith and fancy as architect and builder.

The Hidden Structure (Chemistry). Feb. 14, 16. The Shang bronze craftsmen of China and the Samurai swordsmiths of Japan are the starting point for this journey, which leads from the beginnings of chemistry to Dalton's atomic theory and our knowledge of the elements.

Music of the Spheres (Mathematics). Feb. 21, 23. This film traces the evolution of mathematics and explores the relationship of numbers to musical harmony, early astronomy and perspective in painting. It follows the spread of Greek ideas through the courts and bazaars of the Islamic empire to Moorish Spain and Renaissance Europe.

The Starry Messenger (Astronomy). Feb. 28, Mar. 2. Here is the story of man's early attempts to map the forces which move the planets. Dr. Bronowski traces the origins of the scientific revolution through the conflict between fact and religious dogma, culminating in the trial of Galileo.

The Majestic Clockwork (Physics). Mar. 7, 9. In the evolution of physics, the contributions of Newton and Einstein occupy center stage. This film explores the revolution that ensued when Einstein's theory of relativity upset Newton's elegant description of the universe.

The Drive for Power (Industrial Revolution). Mar. 14, 16. Industrial and political revolutions altered man's concept of power during the 18th century. Dr. Bronowski shows why these developments were as significant as the Renaissance in man's progress.

The Ladder of Creation (Theory of Evolution). Mar. 21, 23. This film journeys from the valleys and waterfalls of Wales to the jungles of the Amazon to explore the controversy swirling around a startling new theory of evolution developed simultaneously by Alfred Wallace and Charles Darwin.

World Within World (Atomic Energy). Mar. 28, 30. Commencing with a visit to an ancient Polish salt mine, Dr. Bronowski looks at the world inside the atom. He traces the history of the men and ideas that have made 20th century physics "the greatest achievement of the human imagination."

Knowledge or Certainty (Science and Humanism). Apr. 4, 6. Dr. Bronowski offers his personal view of the moral dilemma that confronts today's scientists. He contrasts humanist traditions with the inhumanities of the Nazis, the harnessing of nuclear energy with the development of the atomic bomb.

Generation Upon Generation (Genetics). Apr. 11, 13. This film examines the complex code of human inheritance—from the experiments of pioneer geneticist Gregor Mendel to the discoveries of today's sophisticated laboratories.

The Long Childhood (The Future). Apr. 18, 20. In this closing film, Dr. Bronowski draws together the many threads of the series as he takes stock of man's complex and sometimes precarious ascent.

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JANUARY at Field Museum

SPECIAL PROGRAMS

Continuing:

Craft Demonstrations and Discussions

"Use of Natural Materials in the Crafts of Native North America, Africa, and Modern America," 10:00 a.m. to 12:00 noon, Mondays, Tuesdays, and Wednesdays. Entrance to Hall 27.

"Traditions of Native North America," 10:00 a.m. to 12:00 noon and 2:00 to 5:00 p.m., Fridays. Hall 4.

Begins January 6:

Weaving demonstration by members of the North Shore Weavers' Guild from 10:00 a.m. to 12:00 noon on Mondays, Wednesdays, and Fridays. Spinning also shown on the first and third Mondays of each month. South Lounge.

"Ascent of Man," free film series presented at 2:00 p.m. Fridays and Sundays through April 20. All programs will be in the Lecture Hall with the exception of February 9 and 16, which will be in the North Meeting Room.

The one-hour films cover a time span of more than two million years in exploring scientific discoveries that have shaped human history.

January 24 and 26: "Lower than the Angels"
January 31 and February 2: "Harvest of the Seasons"

CHILDREN'S PROGRAM

Continuing:

Winter Journey for Children, "Cats, the Graceful Hunters," focuses on the differences and similarities of these creatures, from the domestic variety to its larger relatives (lion, tiger, etc.) All boys and girls who can read and write may participate in the free, self-guided tour of Museum exhibits. Journey sheets in English and Spanish available at entrances. Through February 28.

MEETINGS

Jan. 8, 7:00 p.m., **Chicago Mountaineering Club**
7:30 p.m., **Windy City Grotto, National Speleological Society**
Jan. 10, 8:00 p.m., **Chicago Anthropological Society**
Jan. 12, 2:00 p.m., **Chicago Shell Club**
Jan. 14, 7:30 p.m., **Nature Camera Club of Chicago**

COMING IN FEBRUARY

Begins February 8:

Ray A. Kroc Environmental Education Program offers a Winter Botany Course, featuring a 9:00 to 11:00 a.m. workshop on Saturday, February 8, followed by field trips on Saturday, February 15 and 22.

A non-refundable fee of $15 for non-members and $12 for Members includes class session, field transportation, and lunch on field trips. Classes limited to 25 adults. For reservations mail checks payable to Field Museum, with name, address, and phone number, to Environmental Programs, Field Museum, Roosevelt Road at Lake Shore Drive, Chicago 60605.

Sunday, February 9 and 16:

30th Chicago International Exhibition of Nature Photography, a slide show featuring winning and accepted color transparencies, 2:00 p.m. in Lecture Hall.

Continuing:

"Ascent of Man" film series, 2:00 p.m. Fridays and Sundays. All programs will be in the Lecture Hall with the exception of February 9 and 16, which will be in the North Meeting Room.

February 7 and 9: "Grain in the Stone"
February 14 and 16: "The Hidden Structure"
February 21 and 23: "Music of the Spheres"
February 28 and March 2: "The Starry Messenger"

Free Ayer Adult Illustrated Lecture Series, "Expeditions Unlimited 1975," presented by Field Museum curators at 7:30 p.m. Fridays and 2:30 p.m. Saturdays in Lecture Hall.

Seating is limited to 225 persons. For reservations call Field Museum, 922-9410, Ext. 230. Museum cafeteria is open until 7:30 p.m. Fridays.

February 21 and 22: "The Changing Alaska Eskimo Culture," by James W. VanStone.
February 28 and March 1: "Natural History of Deep Sea Fishes," by Robert Johnson.

Craft demonstrations and discussions.

Weaving demonstrations.

MUSEUM HOURS

Open 9:00 a.m. to 4:00 p.m. Monday through Thursday, 9:00 a.m. to 9:00 p.m. Friday, and 9:00 a.m. to 5:00 p.m. Saturday and Sunday. Closed New Year's Day.

The Museum Library is open 9:00 a.m. to 4:00 p.m. Monday through Friday. Please obtain pass at reception desk, main floor north.

Museum telephone: 922-1410

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Field Museum of Natural History Bulletin

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COVER

An early 20th-century rubbing of a stone engraving traced from a painting by Feng T'ien, mid-Ch'ing dynasty (1644-1912). It represents Bodhidharma, founder of Ch'an (Zen) Buddhism in China, shown crossing the Yangtze on a reed. Provenience of stone: Confucius temple, Hsi-an. Silk screen prints of this and several other rubbings in the Field Museum collection are available at the Museum gift shop. Catalogue No. 244821.

Photos

Page 3: Philip Hanson; *p. 4:* Darrel Murray; *pp. 5, 6, 7 (all photos):* Philip Hanson; *p. 8:* Frederick Schram; *pp. 10, 11:* courtesy of the Oriental Institute, University of Chicago; *p. 12:* Field Museum; *p. 13 (top):* Brian Posey, *(bottom):* David Moore.

Field Museum of Natural History
Established 1893

Director: E. Leland Webber

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Wolf Road Prairie

by Philip Hanson

Fifteen miles west of the Chicago Loop, in the suburb of Westchester, is one of the most remarkable tracts of land in the Midwest. At a glance from the car window it may appear to be merely a great, vacant field that lies patiently awaiting the developer's bulldozer. Curiously, that nearly happened a half century ago, before the great Crash, and if you get out of your car and start walking through the tall grasses you will come upon block-long stretches of concrete sidewalks, nearly overgrown now and hidden by the flourishing plants.

Philip Hanson is a researcher/assistant for the Department of Education.

This eighty-acre tract, commonly called Wolf Road Prairie, is located northwest of the intersection of 31st Street and Wolf Road. Except for the ancient, cracked sidewalks that enclose what was to have been eight city blocks, this corner of land with its wealth of prairie growth, is much as it was two hundred years ago. For that matter, it probably has not changed substantially in the last few thousand years. It is that rare entity: native prairie. The only incursion into its tranquillity are those wobbly concrete paths, laid down during the boom of the twenties. Had it not been for the Depression, the area would now be just another subdivision, dotted with homes.

In former times—before the European settlers ar-

rived—a vast ocean of prairie stretched all the way from the Rockies to the Great Lakes. At the Rockies' eastern slope the annual rainfall was but 20 inches; as a result, prairie grasses and other herbs in that region did not grow very tall. Eastward, across the plains, the rainfall gradually increased, and the prairies of what is now Illinois received about 35 inches of rainfall annually. Here the prairie grasses could shoot up to eight or ten feet by the end of a favorable season.

The early settlers that came to Illinois from the east and the north had encountered nothing but forest since they first landed on the continent, and their methods of hunting and foraging were adapted to a woodland environment. They were thus ill-prepared for the vast stretches of prairie, with grasses so tall they could hide a man on horseback or an entire herd of cattle.

Settlers knew from experience that soils fertile enough to support a luxuriant growth of forest could also support farm crops. But they viewed prairies and prairie soils with suspicion. They reasoned that any soil that did not seem to grow shrubs—let alone trees—would not be fertile enough for crops. Even if it had been fertile, the soil was virtually clotted with roots of the prairie plants, so that breaking the sod with the crude plows of that time was almost impossible.

In the late 1830s, however, John Deere perfected his revolutionary plow that was able to turn over the tough and sticky sod. There was also a growing realization that the prairie was not infertile at all but had, in fact, among the richest of all soils. The death knell was thus sounded for the prairies. In a very short space of time, this unique, highly developed community of plants and animals was surveyed, sectioned, plowed under, and planted to corn, wheat, oats, and beans. A community that had been evolving for ten thousand years—since the retreat of the last glacier—was virtually wiped out in little more than a century.

Today all that remains of the millions of acres of prairies that gave Illinois its nickname—"the Prairie State"—is a few thousand acres scattered piecemeal across the state. Fifteen hundred acres of prairie—the largest single segment of such native prairie—have been preserved at Goose Lake Prairie State Park, in Grundy County. Gensburg-Markham Prairie, in Markham, just south of Chicago, is a tract of some one hundred twenty acres; Woodworth Prairie, near Glenview, is a mere five acres; near Waukegan there are about 200 additional acres.

The size of a prairie is important to its preservation. The larger the tract, the greater the potential variety of native plant and animal species. The greater the number and diversity of species, the more the prairie remnant is able to function like native prairie ecosystems of the past. In the Chicago area there are few tracts of prairie remaining. Those that have not been saved by the action

◄ *A sidewalk, laid down half a century ago in Wolf Road Prairie, is nearly obscured by a profusion of prairie plants. The walkway, however, provides easy access for viewers, who can thus avoid trampling and destroying the precious growth.*

of a community or by some other environment-conscious group are on the verge of being destroyed as suburban areas proliferate. Wolf Road Prairie is an excellent example of such a threatened area.

In recent years, whenever a naturalist would come upon a few prairie species growing along an old railroad right-of-way or an old fence, it has been considered a lucky find. But when we have in our midst today an 80-acre prairie with more than 130 plant species, it is a minor miracle. Even rarer is to have a good prairie in the midst of a metropolitan area with nearly seven million people.

Long before Wolf Road Prairie's near-destruction in the 1920s, the land had come perilously close to conversion to farmland. In the mid-nineteenth century, the western part of Cook County was first opened to settlement. At that time, most land could be bought from the federal government for a dollar or two per acre. Chicago was growing rapidly and most of the land surrounding the city was being made into cropland. But Wolf Road Prairie somehow escaped this fate. County records of ownership and other documents relevant to disposition of this land went up in smoke with the great Chicago fire of 1871. So the only records we have today concerning this property date from no earlier than 1871—some forty years after permanent settlers first came to the region.

A possible explanation for the land remaining in its natural state may be that much of it was too wet for cultivation. Its proximity to Salt Creek—several hundred yards distant—probably exposed it to occasional flooding. Perhaps the only use this area was put to was as grazing land. Prairies can tolerate light grazing, then become reestablished after the animals leave.

The second time that Wolf Road Prairie was nearly obliterated was during the economic boom of the twenties, when speculation in suburban land reached a peak. Money was flowing freely and city-dwellers were quite ready to escape to a new home in the country. Samuel Insull, the utilities magnate, was developing new markets for his electrical power by extending elevated lines to the suburbs. One of these terminated in Westchester. He and other real estate speculators bought land from farmers near these "el" lines in tracts of 40, 80, or 160 acres. The land was quickly surveyed, platted into lots, and readied for the construction of new subdivisions.

The land that makes up Wolf Road Prairie was purchased by one Charles Hough in October, 1924. Within a year, a plan for developing the area had been drawn up and a plat showing the location of streets, alleys, lots, and sidewalks was filed with the Cook County recorder of deeds. A short time later, the sidewalks that now surround eight blocks at the corner of 31st and Wolf Road (about half the total prairie area) had been constructed. It seemed at that time that a piece of history that had survived thousands of freezing winters and hundreds of prairie fires was about to be lost forever and transmuted into the yards and alleys of a new subdivision. Seven-foot-tall stands of big blue-

False dragonhead (Physostegia virginiana)

Blazing stars (Liatris spicata *and* L. aspera) *amidst prairie grass*

Button blazing star (Liatris aspera)

stem grass would soon give way to trim, cropped lawns of bluegrass.

In the meantime, lots in this subdivision were being sold. Some people bought only one or two lots and some speculators bought scores of lots. The end result was that nearly six hundred lots became divided among one hundred separate owners.

Toward the end of the 1920s, signs of the impending depression began to loom. In 1927 the real estate market slumped. The final blow was the crash of 1929, when most of this development came to an absolute halt.

Development of Wolf Road Prairie also stopped, the only "improvement" upon the land being the pouring of the concrete sidewalks. It is probable that the developer went into bankruptcy. The lot owners were stuck with land which, as far as they were concerned, could not be developed. The lots which were 25 or 33 feet by 120 feet had no sewer systems, and a septic tank could not be installed unless the property concerned was at least half a city block in size. It was these unusual circumstances that prevented the prairie from being destroyed.

The original beauty and grandeur of the prairie is known to us only through the accounts of early settlers. One such account, dated 1855, tells of a man riding in a wagon across the wet prairies just south of Chicago. The grass was so tall that he lost his way, and wandered aimlessly for hours. Finally he came to a small rise from which he could see the elevation of Blue Island, the hill upon which that suburb was later built.

Plants that were as common to the prairies then as dandelion and chickory are to the roadsides today, can now be found together only in places such as Wolf Road Prairie. In springtime the prairie is a fresh green accentuated with the deep blue of prairie violet, the rich gold of the hoary puccoon, and red of Indian paintbrush.

As the growing season progresses and plants grow taller, there is greater competition for sunlight. Plants that remained close to the ground in the spring are now shaded out and replaced by plants that grow and flower at greater heights. At this time of year—July and August—the most spectacular display of prairie flowers appears. Plants such as Turks cap and the prairie lilies lend their fiery orange to the bright green landscape. In midsummer, great patches of prairie turn reddish-purple when the marsh blazing star and the button blazing star send up flower stalks three to five feet tall. In the low, wet areas of the prairie's central section the rare white fringed orchid and the white ladies' tresses orchid grow.

In the fall, the asters make their appearance. These are followed shortly by the bright blues of the prairie gentian and the closed gentian. With the arrival of these flowers, the end of the prairie's growing season is at hand. Most of the plants have finished their job of making seed for next year's colorful array. Still other plants have spent the spring, summer, and fall storing food in their

Top: Wild rose (Rosa carolina); *bottom: closed gentian* (Gentiana andrewsii)

underground parts so that when favorable conditions arrive with spring they can immediately begin to grow and make full use of the weather.

Unique to Wolf Road Prairie today is a cluster of burr oaks. It was these trees that formed groves scattered here and there across the ocean of prairie. Their tough, thick, corky bark protected the trees from the fires that frequently raged across miles and miles of prairie in the spring and fall. When the prairie was first settled, these groves provided wood for fuel and lumber for buildings. The groves were usually the first areas settled. Many present-day communities, such as Downer's Grove, Elk Grove, and Long Grove, are named for clusters of such trees.

Wolf Road Prairie, in a sense, is a fragile bridge with the past. It gives us a view, in miniature, of what was once a great panorama, and is accessible to almost seven million residents of northeastern Illinois and northwestern Indiana. The sidewalks are fractured reminders of someone's attempt, long ago, to "improve" the land. But today these concrete paths serve the very useful function of allowing us to visit the prairie and get into intimate contact with it without trampling and destroying the plant life. The area is thus a ready-made nature study area. Local biologists and naturalists acclaim the high quality of Wolf Road Prairie. The Illinois Nature Preserves Commission observes that it is "of nature preserve quality." The Northwestern Illinois Planning Commission has gone on record that this prairie "quailfies as first priority open space." Clearly, Wolf Road Prairie must be preserved.

Not too many years ago, just a few miles northwest of Wolf Road Prairie, in Elmhurst, there was another prairie remnant, considered by ecologists as the finest example of black soil prairie in the state. But that precious land was bulldozed over and buried beneath the Tri-State Tollway, Interstate 294. No amount of citizen action will ever bring that prairie back to life; it is dead and gone. Now, before it is too late, community and legislative action can save Wolf Road Prairie from a similar fate.

It is essential that the prairie be acquired in its entirety from the scores of individuals who still have ownership in the many tracts that comprise it. Only as a single, unbroken tract can it be maintained and managed in its native state, and properly utilized as a natural resource.

In its series of Ray A. Kroc Environmental Programs, Field Museum will sponsor tours of the Wolf Road Prairie on May 31 and June 4. On Saturdays, during the summer, the Save the Prairie Society will provide guided tours of the area. □

The dedicated group now struggling to save Woll Road Prairie is Save The Prairie Society, 618 Robinhood Lane, LaGrange Park, Ill. 60525.

Prairie gentian (Gentiana puberla)

Indian plantain (Cacalia tuberosa)

Festival Hall of Tutmosis III, a special chapel built within the confines of the Temple of Karnak

Tutmosis III: History's First Male Chauvinist?

by Frederick R. Schram

In Gerda Frank's "'Pharaoh' Hatshepsut, History's First Liberated Woman," (Sept., 1974, *Bulletin*), we learned the intriguing story of ancient Egypt's Queen Hatshepsut; but the events surrounding the life of her nephew-stepson-son-in-law (and possible husband), Tutmosis III, are equally remarkable. He might even be described as history's first male chauvinist.

Tutmosis III occupied the throne of Egypt from 1490 to 1436 B.C.; but his first twenty-one or twenty-two years on the throne were largely overshadowed by Hatshepsut, his coregent, with whom he nominally shared power. Though Tutmosis III's ascent to the throne was initially quite promising, two decades were to pass before he was able to fully assert himself. The circumstances surrounding his accession are best appreciated if one understands the manner of inheritance in ancient Egypt and if one studies the genealogy of the XVIIIth dynasty, Tutmosis' family.

Inheritance of property and title in ancient Egypt was matrilineal. The oldest surviving daughter of a house inherited all. Although a woman's husband obtained complete control of the estate with marriage, he retained this control only as long as his wife lived. Upon her death, all rights passed to the wife's oldest daughter. Such a restriction did not inhibit the ancient Egyptians, however, since a widower could, and frequently did, then marry his daughter. Or a father wishing to ensure his son's future could marry his son to his daughter: a brother-sister marriage. It was also acceptable for a boy to marry his father's wife, close cousin, or half-sister. Under such circumstances family lineages and interrelationships could become impossibly confused, especially if viewed thirty centuries later.

Frederick R. Schram, who has had a lifelong interest in Egyptology, is a research associate in the Department of Geology at Field Museum, and an associate professor of zoology at Eastern Illinois University.

The XVIIIth dynasty initiated what is called the New Kingdom period of Egyptian history. Ahmosis I was the founder of the dynasty. He expelled the Hyksos, or "shepherd kings," who were foreigners—apparently from Palestine—and who had invaded Egypt during a dark age and then controlled a large part of the country. Ahmosis' son and successor, Amenhotep I, began the establishment of the empire by initiating conquests beyond Egypt's traditional borders. Amenhotep's legitimate heir was a daughter, Ahmose. Amenhotep had a brother-in-law, Tutmosis, a military man who married Ahmose, then succeeded as Tutmosis I. The only heir of Ahmose and Tutmosis I was a daughter, who eventually became the great Queen Hatshepsut. Hatshepsut was married to Tutmosis II, a son of Tutmosis I by a princess of his harem. Hatshepsut and Tutmosis II also had only daughters; one of these—Meryetre—survived to marriageable age.

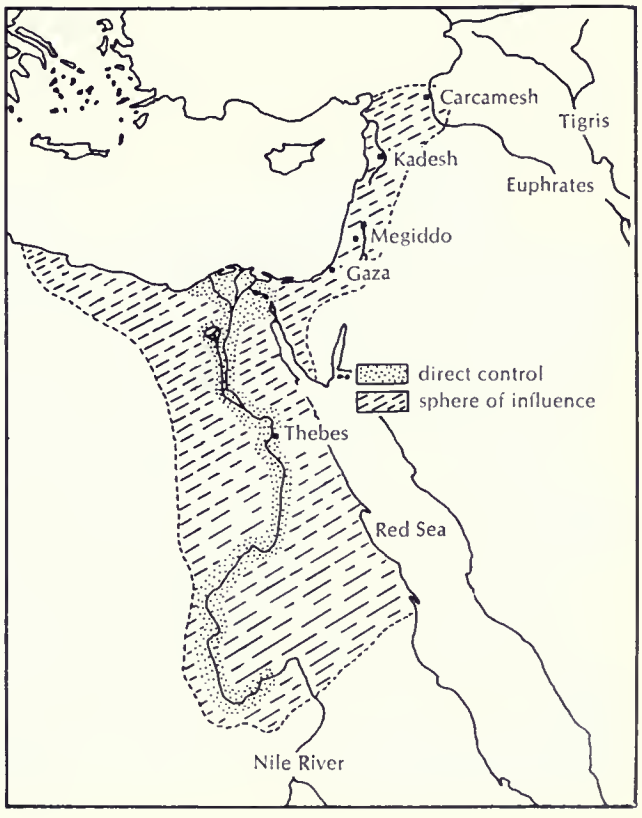
Tutmosis II had several children by minor wives or concubines of his harem. One of these was a boy, also named Tutmosis. This young Prince Tutmosis had been shuffled off at an early age to serve as a junior priest in the Temple of Amun (the chief god of Egypt) at Karnak, in Thebes, the capital city. Prince Tutmosis was not destined to sink into the obscurity of a temple acolyte. He became his father's successor-designate in a rather startling manner. We learn this story from a propaganda stela from late in the reign of Tutmosis III.

During a festival in the Temple of Karnak, Tutmosis II was offering sacrifice to Amun. As part of the ceremonials, the image of the god was carried about the sacred precincts. A dramatic coup d'état took place. As the god, carried by the priests, passed around the hall outside the holy-of-holies of the temple, the procession passed in front of Prince Tutmosis. According to accounts, the priests were forced to falter before the prostrate young apprentice, and the god indicated that the junior Tutmosis was to rise. The god Amun then placed the boy in the exact spot in which the pharoah himself had stood during the ritual a few moments before. Whether this all happened with the cooperation of King Tutmosis II, or whether it was an act of conspiracy against him and Queen Hatshepsut (who seems to have acquired great power even at that date) we do not know. Thus, we have the picture of the king, Tutmosis II, offering a sacrifice to the chief god, and shortly thereafter the god Amun placing someone else in the place of the king.

To comprehend the radical nature of this incident we must remember that Prince Tutmosis had only a small claim to the throne. His mother was a concubine named Ese, a minor wife of the harem. His father, Tutmosis II (who was the son of a princess and Tutmosis I), had no claim to the throne, except by marriage. What the actual role of Prince Tutmosis was in planning the coup that took place in the Temple of Karnak, and in carrying it out we may never know. But in view of what we know of Tutmosis III's character as pharoah, we might surmise that it was something more than completely passive. The young prince could perceive his lack of family position and separation from all sources of power and he may have felt that he had nothing to lose. Logically he might have sought an alliance with the chief priests of Amun, who had been jockeying for position and power.

But whatever forces had been marshalled on the side of the prince, they were insufficient to overcome those allied with Queen Hatshepsut. We may assume that upon the death of Tutmosis II, Tutmosis and Hatshepsut were married in order to solidify Tutmosis III's "divine" claim to the throne, although there is no record of this marriage. Both Hatshepsut and Tutmosis III date the beginning of their reigns with the death of Tutmosis II. But at this point in history, as we noted in Mrs. Frank's essay on Hatshepsut, Tutmosis III virtually disappeared for twenty-one years while Hatshepsut ruled alone, although he apparently studied tactics and conducted two campaigns later in her reign.

In 1469 B.C., or thereabouts, Hatshepsut died. Her glorious reign of peace had been marred in its last years by growing unrest and rebellion in Palestine and Syria—lands conquered by her father, Tutmosis I. The "peace party" of Hatshepsut had concentrated all its efforts on expanding trade and in diplomatic activities. Some Egyptologists have speculated that Hatshepsut may have been assassinated as one step toward returning the "war party" to power and in institut-



THE EGYPTIAN EMPIRE UNDER TUTMOSIS III

ing a more aggressive imperial policy. At any rate, after two decades of seclusion, Tutmosis III ruled alone.

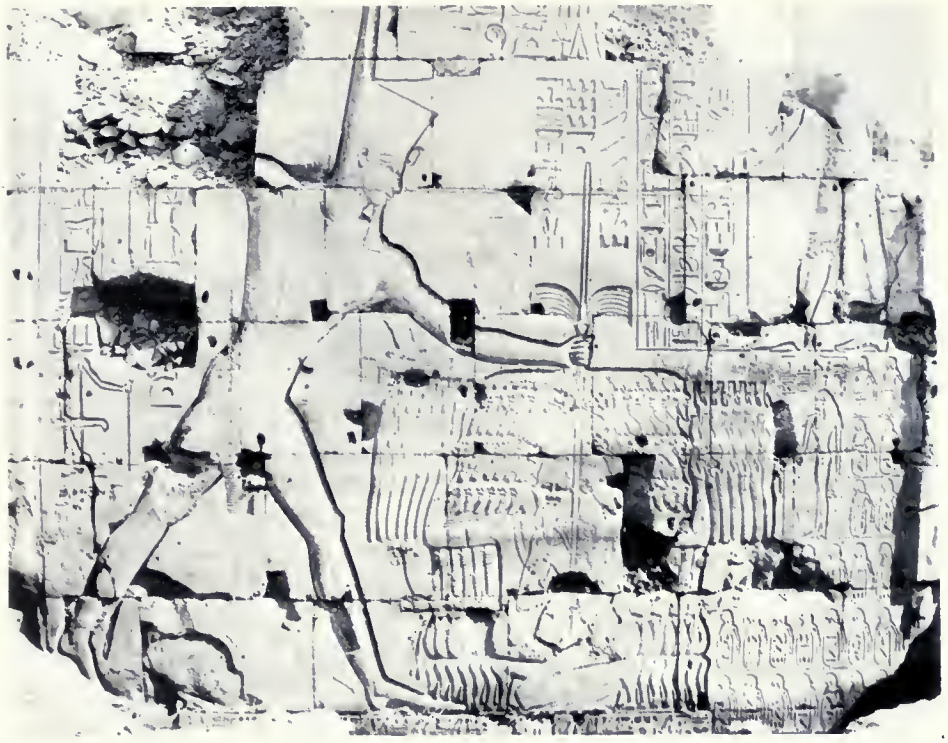
Upon assuming sole regency he began to obliterate the memory of Hatshepsut. He ordered his agents to efface her name and image from every monument and building in the land. The history of Egyptian purges are hard to trace, since they often extended through several dynasties and hundreds of years, and monuments were sometimes usurped by a whole succession of pharoahs. Fortunately for history, they were not entirely successful. One of the buildings attacked was the magnificent and justly famous funerary temple of Hatshepsut at Deir el Bahri on the west bank of the Nile, directly across from the Temple of Karnak. Every statue of the queen there was torn down and every image on the wall reliefs was chiseled out until only outlines of the portraits remained. Tutmosis even ordered the bases of the obelisks Hatshepsut erected in the Temple of Karnak to be bricked up out of sight in order to cover her name. Twenty years of frustration and abuse were vent in this one colossal purge. Tutmosis III never officially acknowledged his years of coregency with Hatshepsut, and neither Tutmosis nor Hatshepsut seems to have been eager to advertise their marriage, which may have occurred.

Tutmosis III's energies and talents, which had been subdued during Hatshepsut's reign, suddenly burst forth with the organization of an expeditionary army for a Syrian campaign, the first such Egyptian force since the minor campaigns of Tutmosis II. The ancient mideast empires were not empires in our modern conception of the term. These empires were more like "spheres of influence," with the "conquered" states being restricted in trading rights and required to pay yearly tribute to the conquering nation. Thus, rebellions in such empires were not so much movements toward political independence as attempts at economic freedom.

The princes of Palestine and Syria had formed a confederation against the pharoah under the leadership of the ruler of the city of Kadesh, on the Orontes River in Syria. Even in those ancient times the Palestine territory was in dispute. The confederacy amassed their forces at the city of Megiddo (just southwest of present-day Nazareth). In the twenty-third year of his reign (Egyptians had no calendar dates as we have, but started counting the years anew with the beginning of each pharoah's reign), Tutmosis marched into Palestine, captured what is today Gaza, and laid seige to Megiddo. After seven months the princes capitulated and sued for peace, and, as one of the propaganda stelae of Tutmosis tells us, they dragged themselves before his majesty, kissed the ground before him, and implored breath for their nostrils.

The tribute paid was truly staggering: immense quantities of gold and silver, ebony, great herds of cattle, and all the grain from the surrounding region. After receiving all this, Tutmosis and his army returned to Egypt. But from the years 23 to 39 he found it necessary to wage fourteen separate campaigns against the recalcitrant Syrians. In the year 30 he destroyed Kadesh itself, and in the year 33 he chased his enemies across the Euphrates River at Carcamesh (on the border of modern Syria and Turkey). He then proceeded into northern Mesopotamia, giving the Egyptian empire the greatest extent it was to ever have. He had to continue to show his royal presence in Syria until the year 42 of his reign.

Festival Hall of Tutmosis III, interior view, looking northeast



Relief of Tutmosis III at the Temple of Amun. The king is shown smiting captives before Amun.

Not all of Tutmosis' military activity was confined to Syria. He also pressed his armies south into Nubia and went as far as the fourth cataract of the Nile, deep inside what is modern Sudan. There, in the year 47, he erected a monument stela commemorating his great conquests in Syria—undoubtedly in order to deter any potential Nubian rebels.

These great military conquests brought vast amounts of wealth and tribute flowing into the Land of the Nile. Unprecedented prosperity was afloat. Impressive building programs were undertaken. Records of Tutmosis' victories were carved on the walls of these buildings, especially in Thebes at Amun's Temple of Karnak. Tutmosis never seemed to tire of trumpeting his conquests. And perhaps in this he was also trying to outshine the recorded peacetime accomplishments of Hatshepsut.

His devotion to the architectural enrichment of the Temple of Amun is understandable, since that was in a real sense where it all began. Carvings of wall reliefs executed under Tutmosis' direction abound everywhere. He erected several great obelisks there; one of these is now in New York's Central Park, another in London, and a third in Istanbul. He also built a great "festival hall" to the east of the main temple. One cannot but wonder how many times, after offering sacrifice to Amun, did Tutmosis gaze upon the spot where he had once stood as a young prince and the god had designated him to succeed his father. And how many times, when he walked past her obelisks, did he shudder at the thought of those bitter years in the shadow of Hatshepsut?

After Hatshepsut's death, Tutmosis had to marry her daughter by Tutmosis II, Hatshepsut-Meryetre, in order to maintain his control of the throne. A son born to this marriage eventually succeeded his father as Amenhotep II. Tutmosis III's days ended peacefully enough. He did not personally partake in any more military campaigns in the last years of his life. That sort of activity was undoubtedly left to his son, Amenhotep, who Tutmosis made coregent. After such an eventful career, filled as it was with such reckless gambles, great frustrations, and stunning victories, Tutmosis spent the last years of his reign enjoying the fruits of his efforts.

Or did he? Such a dynamic, forceful character may have found the infirmities of old age the supreme frustration. He died in the year 54 of his reign, something in excess of 60 years of age, perhaps approaching 70.

Force of personality was the chief character trait of Tutmosis III—"charisma," as we would call it today. Charisma to achieve the succession, charisma to stamp out the "peace party" and Hatshepsut's memory, charisma to lead his armies again and again to victory, charisma to launch mammoth building programs. A measure of Tutmosis' dominant personality is noted in the following poem of praise carved on a stela by the priests of Amun in the Temple of Karnak. This song is uttered in words from the mouth of the god Amun himself. It gives a hint of the impression Tutmosis III must have made on his peers. How much more glorious and compelling, in the eyes of his contemporaries, were the feats of a conqueror like Tutmosis III, than the "peaceful coexistence" of Queen Hatshepsut.

I have come. I have let you smite the princes of Zahi.
I have hurled them beneath your feet among their mountains.
I have made them see your majesty as a lord of radiance,
So that you have blazed in their faces as my image.

I have come. I have let you smite the Asiatics.
You have made captive the heads of the Asiatics of Retenu.
I have made them see your majesty adorned with your ornaments,
When you received the weapons of war on your chariot.

I have come. I have let you smite the ►

Sandstone figure of the scribe Amenhotep, of the same period (dynasty XVIII) as Tutmosis III; on view in Hall J, Case 40. Catalogue No. 88906. About 16½ inches high. The skin is painted red, the hair black, and the costume white.

The inscription reads: "The scribe Amenhotep, he says: 'I praise my lord, the lord of the gods, Amun, lord of thrones of the two lands (Karnak), Harakhte, god great in deeds, sole one, without his equal, with beautiful rays, with sparkling graciousness, my son, lord of dawnings. Thou art verily breath to the nostrils. I have come unto thee that I may praise thy beauty, when thou dawnest in the east of the sky (and) until the setting of the sun in the Manu Mountains. Let me be in the retinue of thy spirit, my mouth provided with viands which have been offered on thy altars.' (Said) by the scribe of the steward of the high priest, Amenhotep."

Land of the East.
You have trampled those in the district of God's Land.
I have made them see your majesty as a circling star,
When it scatters its flame in fire and gives forth its dew.

I have come. I have let you smite the Land of the West.
Crete and Cyprus are in terror.
I have made them see your majesty as a young bull,
Firm of heart and horned.

I have come. I have let you smite those in the marshes.
The lands of the Mitanni tremble in fear of you.
I have made them see your majesty as a crocodile,
Lord of fear in the water and unapproachable.

I have come. I have let you smite those in the isles.
Those in the midst of the great sea hear your cry of war.
I have made them see your majesty as an avenger,
Rising upon the back of his victims.

I have come. I have let you smite the Libyans.
The isles of the Utentiu belong to the might of your prowess.
I have made them see your majesty as a fierce lion,
While you made corpses of them in their valley.

I have come. I have let you smite the corners of the lands.
The circle of the Ocean is caught in your fist.
I have made them see your majesty as a soaring hawk,
Seizing all that which he desires.

I have come. I have let you smite those who are on your borders.
You have made the Nomads prisoners.
I have made them see your majesty as the southern jackal,
Swift and stealthy as he crosses the Two Lands.

I have come. I have let you smite the Troglodytes of Nubia.
As far as the Land of Chah in your fist.
I have made them see your majesty as two brothers,
For whom I united the strength of their arms. □

field briefs

"Lizards, Snakes, Toads, and Salamanders" was the title of a recent all-day program for youngsters at Field Museum. Sponsored in cooperation with Lincoln Park Zoo, the program featured live-animal demonstrations and films.

Upper left, Jeannie Gabor of the Zoo docent staff introduces a youngster to an iguana, from tropical America. *Lower left,* Lincoln Park Zoo's Lorraine Smith tries to coax her audience into petting the friendly boa. (The upper photo was taken by Brian Posey, the lower photo by David Moore; both 14-year-old boys are Field Museum members.)

Canadian Wilderness Trip

Eight days and seven nights in Ontario's Quetico Provincial Park (bordering Minnesota) are in store for 30 lucky young people. The July canoe trip will explore one of Earth's last remaining primitive wilderness areas. It will be co-sponsored by Field Museum and the Voyageur Wilderness Programme, of Canada, and is open to persons 14 to 22 (members or members' children).

Led by two naturalist guides and four adult counselors, the group will leave Field Museum on the evening of July 1 and be back in Chicago on the morning of July 11. The trip fee of $180 will include transportation, complete outfitting, lodge meals, and insurance. Applicants will be required to submit a parent's statement of swimming ability and medical disabilities, provide a teacher's name as reference, and come to the Museum for an interview; the applicant should also be able to demonstrate "enthusiasm for a taste of wilderness." The group leaders hope to choose an equal balance between boys and girls. Preference will be given to those who apply first, but acceptance is at the discretion of the Museum. Upon acceptance, applicants will be required to make a $50 deposit; the balance must be paid by May 15. For further information call Field Museum, 922-9410, Ext. 352.

"Amber" Jewelry Recalled

To the chagrin of Field Museum staff, it has been shown by laboratory analysis at the Museum that some African "amber" jewelry, acquired in conjunction with last year's Contemporary African Arts Festival, does not contain true amber. The Museum suggests that anyone who has bought such jewelry at the Museum return it for authentication by laboratory analysis. Any article that does not pass will be replaced or full refund will be made to the purchaser. The disclosure came as a shock to buyers for the festival, who made every effort to establish the authenticity of merchandise.

our environment

Nuisance Species Banned in West

A number of undesirable wildlife species have been banned from importation into several western states by recent action of the Colorado River Wildlife Council, an association of state wildlife agencies in California, Arizona, Utah, Nevada, Wyoming, New Mexico, and Colorado.

More than 26 species of fish, amphibians, and reptiles determined to be undesirable to native wildlife are now illegal for importation into or transportation or possession in those seven western states. Outlawed fish include lamprey, freshwater stingray and shark, bowfin, gar, gizzard shad, European whitefish, banded tetra, piranha, candiru, white perch, drum, grass carp, pike top minnow, snakehead, walking catfish, and tiger fish. Amphibians and reptiles that have been banned include marine toad, African clawed frog, crocodile, alligator and caiman, snapping turtle, cobra, viper, nonnative rattlesnakes and coral snake, and the boomslang.

Giant Cache of Contraband Ivory

A giant cache of contraband elephant tusks has recently been discovered in a Nairobi, Kenya, warehouse. Packing cases, ready for shipment to overseas markets, were found to contain 800 of the ivory tusks. Their market value was put at $1.5 million.

Private trade in ivory has long been illegal, and the governments of Kenya and other East African nations are constantly seeking out violators. Nevertheless, large amounts of the commodity continue to be sumggled to Europe and Asia.

Freighters Pose Health Threat

Sewage discharged into the Great Lakes by vessels arriving from ports where communicable diseases are epidemic may be creating a potential health hazard.

This conclusion resulted from an inquiry made by the International Joint Commission, Great Lakes Regional Office following the 1973 cholera epidemic in Naples.

The commission concluded that although incidents of communicable diseases introduced by vessel waters have not occurred recently, "there is no question that raw sewage and other vessel wastes continue to be dumped into the Great Lakes by ships which have earlier left ports in infected areas."

The commission reported the absence of communicable disease outbreaks in and around the Great Lakes is due mostly to the "relatively high level of treatment of municipal water supplies." But, it states, "health agency officials cannot provide assurances that there is no need to be concerned with the potential hazard from vessel wastes."

According to the IJC, there is no single agency in either the Canadian or U.S. government with clear-cut authority and responsibility to deal with vessel wastes problems. It recommends the U.S. and Canadian governments adopt compatible vessel waste regulations and procedures to assure "adequacy of sewage handling, treatment and disposal procedures and adequate surveillance of these procedures, especially as they are applied to vessels from high risk areas."

Federal Incentive for Auto Bans

The federal government has offered cities a $15 million "carrot" to persuade them to ban autos from their downtown areas.

According to Frank C. Herringer, administrator of the Urban Mass Transportation Administration, $15 million in technical studies grant, which do not require local matching funds, will be made available to cities willing to experiment with banning autos in all or part of their downtown areas or by instituting "congestion pricing," in which motorists are charged fees to enter crowded areas. Additional federal funds will be made available to help purchase buses for inside the auto-free zones.

Herringer predicted "we could well see a federal requirement that cities at least consider auto-free zones" as a prerequisite to applying for federal transportation grants; he indicated that the government would favor cities which adopt such an approach.

Feds Raid Feather Shops

In a series of raids in eleven states, U.S. Fish and Wildlife Service agents have recently seized thousands of eagle and migratory bird feathers, dozens of eagle and migratory bird carcasses, and hundreds of American Indian curios made with parts of federally protected birds. More than sixty persons were either arrested or issued summonses for trafficking in eagles and migratory birds. Most of those cited were selling prohibited items to tourists and collectors, in violation of federal laws forbidding all commercial activities involving eagles and migratory birds.

The searches and seizures took place in homes, curio shops, taxidermy businesses, pawn shops, and other business establishments in Indiana, Illinois, Wisconsin, Minnesota, South Dakota, Colorado, Montana, Wyoming, Idaho, Oregon, and Washington. Manufactured articles seized included mounted birds, headdresses, pipes, necklaces, dolls, spears, bustles, and hundreds of other feather-decorated curios. Over two dozen species of protected birds, including the bald and golden eagles, were involved. Some of the feathers seized had been trimmed or otherwise altered to disguise their true identity and to make them look old.

As the popularity of American Indian articles has increased in recent years, a lucrative market has developed for the eagle and migratory bird parts and feathers used to decorate Indian curios. Eagle carcasses currently sell on the black market for $175; hawk carcasses bring up to $45. Wing and tail feathers of these birds are used to make warbonnets and to decorate wearing apparel and other articles. Most bonnets and headdresses sell in the $400 to $700 price range, but some have been offered for sale for as much as $1,500. It takes the feathers of as many as ten eagles to make some types of bonnets. While federal law expressly prohibits commercial activities involving eagles and migratory birds, the U.S. Fish and Wildlife Service issues eagle parts or feathers free to Indians by special permit for bona fide religious ceremonies. The Department of the Interior maintains a repository where the remains of eagles that are killed by accident or die naturally are stored for such free distribution.

The Bald Eagle Protection Act carries a maximum criminal penalty of a $5,000 fine and one year in jail for first offenses. The Migratory Bird Treaty Act provides for $2,000 fine and two years in jail for persons convicted of selling protected birds.

No Ill Effects in Asbestos-Fed Rats

There is no evidence that asbestos fibers entering the body through the gastrointestinal tract cause cancer, according to long-term studies by three laboratories. Findings of this research were reported in the December, 1974, *Archives of Environmental Health*, published by the American Medical Association. The report comes in the midst of heated controversy over the dumping of asbestos-loaded taconite tailings into Lake Superior by the Reserve Mining Co. (See September, 1974, *Bulletin.*)

Laboratories which conducted the research are at the Medical University of South Carolina, at Charleston; St. James Hospital in Leeds, England; and the Institute of Occupational Medicine, Edinburgh, Scotland.

The *Archives* reports:

"Ingestion of asbestos fibers has undoubtedly been in progress in some coun-

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tries for centuries, inasmuch as fibers of submicronic dimensions occur naturally in river water as it erodes sepentine and amphibole outcroppings.

"Increased industrial applications of mineral fibers may have accelerated this ingestion somewhat. Nevertheless, the world literature does not suggest that an alarming increase in gastrointestinal inflammatory disease or cancer has occurred, or that the incidence is higher in regions where asbestos fibers are present in natural waters."

In one experiment, ground laboratory chow was mixed with ball-milled chrysolite asbestos of all fiber lengths and diameters and fed to rats for 21 months. In another, taconite and amosite tailings were ground up and injected in aqueous suspension. In a third, oleomargarine with 20 percent taconite or 10 percent amosite, and butter containing asbestos were fed to the rats.

A few animals from each experiment were killed within six months; the rest were allowed to live until they became diseased or until they died natural deaths. In none of the experiments were any cancerous lesions observed, nor did there appear to be any penetration of the gastrointestinal mucosa by asbestos fibers.

UN Confers on Mediterranean Pollution

One of the world's dirtiest waterways—the Mediterranean Sea—may have cleaner days ahead, thanks to a recent conference of the fledgling United Nations Environmental Program, held at Barcelona, Spain, Jan. 28-Feb. 4. Maurice F. Strong, executive director of the UNEP, has said that condition of this sea "allows no delay if further deterioration is to be halted."

The conferees—primarily representing nations bordering the Mediterranean—discussed research and monitoring programs and joint action to be taken in emergencies. They also considered interlocking agreements on the dumping of land wastes into the Mediterranean, pollution from ships, pollution from exploration and exploitation of the seabed.

U.S.-Russ Pact on Endangered Plants

Trees, vines, grains, and other plants will be grown jointly by the United States and the U.S.S.R., under a recent agreement to help preserve endangered plant species. Under the agreement, detailed information will be exchanged on such species of the two countries, including reports on what is being done to preserve them. Seeds and seedlings will also be exchanged. In both countries there are currently about 500 endangered plant species.

"A plant that doesn't grow well in one country may often hold and flourish in the other country," observed Howard S. Irwin, president of the New York Botanical Garden.

"One of the most important things about the agreement," he continued, "is that the two countries will be preserving the genes of wild plants for possible use in the future all over the world."

Solar Heater for Housing Project

A forty-unit housing project for the elderly, using solar energy for half its heating needs, will soon be constructed near New Haven, Conn. Completion of the $1 million state facility is expected in 1976. A federal grant of $130,700 has been awarded to underwrite designing costs for the solar energy installation.

All forty living units will have heat drawn from conventional oil-fired or gas-fired furnaces, but in the case of twenty units, the conventional system will be there only as a back-up for solar heaters. The solar collectors will consist essentially of flat, black-painted, glass-covered boxes, which will trap the sun's heat. Liquid circulated through pipes in the boxes will carry off the heat and store it in large tanks; from the tanks the hot liquid will be drawn off as needed for heating the twenty units. Currently, there are believed to be less than 100 installations in the United States which depend wholly or partly on solar heaters.

Chimps Can Teach Mothers

Human mothers can learn a thing or two from their chimpanzee counterparts, says Jane Goodall, noted primate ethologist, "We do so many things today that are biologically incorrect and go against traditional baby primate needs." She cited the common practices of allowing infants to feed themselves from propped-up bottles, ignoring children in play pens, and letting infants sleep in cribs away from their mothers. Studies with chimpanzees show that such isolation results in behavioral differences that may be observed years later, Dr. Goodall said.

Michigan's Last Wolf?

The lone survivor of last spring's timber wolf transplant from Minnesota to Michigan was found dead near Champion, Michigan, on November 19. The wolf's death raised serious questions among research biologists as to the eastern timber wolf's ability to survive competition with people in its former range.

The young female's unmoving radio signal was picked up in that area on November 17 from an airplane carrying research biologists from Northern Michigan University. They had been monitoring the wolf transplant periodically since March.

Following a lead from a local hunter, a Michigan conservation officer located the wolf in a densely wooded area. She had been shot in the leg and the head. The radio collar and one ear, which carried a Minnesota tag, had been removed. The dead wolf was positively identified from a Michigan ear tag which was hidden on the other ear. The radio collar, which had been shot off the dead animal and was no longer transmitting, and the ear tag were later turned over to investigators by the occupant of a hunting cabin not far from where the wolf's body was discovered.

Although the project was a failure in terms of wolf survival—all four of the transplanted wolves were shot, trapped, or run over within seven months of their release—the money and man-hours that went into the project were not all spent in vain. David Mech, U.S. Fish and Wildlife Service biologist, reports that evidence now indicates transplanted wolves are capable of maintaining pack identity, establishing territories, and searching for food successfully when introduced into new areas.

Shortly after the recently killed female was captured last March, biologists suspected that she would be a loner, despite the fact that she was captured in close proximity to the other wolves. Even while penned before transport to Michigan, she remained separate from the older female and two males which were displaying close-knit pack behavior.

After their release on Michigan's Upper Peninsula, the three-wolf pack traveled over 150 miles before establishing a territory and settling into a pattern of local movements. The lone female stayed close to the release point in the Huron Mountains, surviving longer than any of the others and gaining six pounds before she was killed. Ironically, an extremely rare native male wolf was reportedly shot the same day not far away. (See January, 1975 *Bulletin*.)

In light of recent discouraging developments, biologists are assessing the advisability of continued transplant efforts. But one question remains unanswered: Can a viable population of the endangered eastern timber wolf be reestablished in northern Michigan? Researchers hope that increasing public sensitivity to the wolf's survival needs may enable them to succeed.

Oak Park's Outdoor Nature Museum: Austin Gardens

by Joyce Marshall Brukoff

Ray Pawfey (left), curator of birds at Brookfield Zoo, and Dominick Meo, director of the Oak Park-River Forest Community Chest, make friends with a feathered resident (Muscovy duck) of Austin Gardens.

Preservation of plants and animals in a natural setting becomes akin to the preservation of artifacts in a museum when we watch the environment of many species crumbling before the encroaching machinery of civilization. With this in mind, the efforts of governmental, civic, and private agencies become vital to the survival of many species through preserves and covenants instituted to protect some of the remaining wild areas supportive of life other than human.

Many of the larger preserves have been given well-deserved publicity, and the various organizations working to save our wilderness have received increased public and government support. Less noticeable and often unheeded are the smaller battles waged in urban and country locations to save postage-stamp remnants of nature. Some of these efforts should be counted as larger in importance than their physical limitations imply, serving as they often do a segment of urban population and land which is starved for the blue of a delicate mertensia blossom or the flashing wing of a purple martin.

One such project is Austin Gardens of Oak Park, a suburb on the western edge of Chicago. Located in the heart of town, at the juncture of Forest and Ontario Streets, Austin Gardens is a wooded sanctuary for plants, land birds, and waterfowl which are largely indigenous to the original Illinois prairie. How Austin Gardens came to be is the story

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Joyce Marshall Brukoff is an Evanston writer with a special interest in environmental affairs.

of one town and its concerned citizens. Their concerted effort to create their own nature preserve was completely unsubsidized by state or federal moneys, and was formed without the aid of any large conservation organizations.

The square block area was originally bequeathed to Oak Park's Park District by the late Henry Austin, with funds for partial development made available through a trust fund. Instead of developing as a typical urban park with flower beds and large tracts of grass, the park evolved as a wildflower patch and, later, into a bird sanctuary. Now a waterfowl pond is being created under the guidance of Dominick Meo, director of the Oak Park-River Forest Community Chest, and Ray Pawley, curator of birds at Brookfield Zoo.

Meo, who contributes hours of volunteer time to the project, originally drew the interest of the park board when he outlined his plans for building bird shelters to protect as many as fifteen different species of birds during the winter. The wildflower area was already growing from a modest beginning in 1970, when Elizabeth Walsh and Julia Sears of the Oak Park League of Women Voters spearheaded the effort.

Agreement with the park district was achieved, and it assumed responsibility for development of a nature study program. Everything else was derived from the time and money of volunteers. The garden's wildflowers began with a few plants in 1970. Water was brought in plastic jugs from various ladies' homes to sustain the delicate group of plantings until they gained a foothold over Eurasian weeds.

Now, more than 100 varieties of wildflowers and ferns may be seen in Austin Gardens from early spring through November. They include: mertensia, red and white trillium, swamp buttercup, wild phlox, bellwort, celandine poppies, shooting star, spotted dead nettle, bloodroot, white baneberry, hepatica, dentaria, ginger, and many more. A "flower watcher" would have to travel hundreds of miles to see the numerous species that have been gathered together in this square city block.

The bird and waterfowl sanctuary took more than earthly toil from a group of devoted ladies. Local architects contributed plans. Funds were raised locally to cover the entire cost of construction and maintenance, which responsibility rested completely outside the sphere of local government. A local artist created a bird poster and a patch which was sold by everybody from the Boy Scouts to the Rotarians; even local banks had donation boxes to attract contributions. In 1972, the first bird house was run up on a 25-foot pole, and Governor Ogilvie stopped by to officially open the gardens. *National Geographic* magazine took note of the effort in a special editorial for children, and publicity grew as the plan developed.

Meo, the man who started it all, commented, "It may be less than a block in size, but it seems much bigger when you have watched the people of this town work so very hard to implement the plan for a working nature preserve at Austin Gardens. We are all very proud."

And well they should be proud. According to Ray Pawley, the following ➤

Elizabeth Walsh (left) *and Julia Sears Babooska tend Austin Garden's expansive carpet of wildflowers.*

birds have been seen in appreciable numbers at Austin Gardens during the first few seasons: resident birds—mourning dove, cardinal, bluejay, crow, black-capped chickadee, nuthatch, starling, rock dove, tufted titmouse, woodpecker, goldfinch, white-throated and Henslow's sparrow; of nonresidents—cuckoo, nighthawk, ruby-throated humingbird, wren, brown thrasher, thrush, robin, cedar waxwing, red-winged blackbird, Baltimore oriole, tanager, purple martin, owl, redstart, cowbird, and junco. The various genera have not been broken down into specific forms in most cases, because of the indefinite locality status of many groups. Therefore, the list is a conservative one, which includes numerous species within several of the above-named families, such as warbler, thrush, and sparrow.

The pond was completed in December, 1974. The water is constantly moving around a small island, and the area is surrounded by a solid redwood fence, broken in a few spots with wrought iron framed viewing areas. A feeder on the island is stocked with food twice a week. For the twelve mallard ducks which pilot the project, this is 65 pounds of food each time the feeder is stocked.

According to Pawley, the mallard ducks were placed in the pond area first in order to establish the pond and lure other waterfowl to Austin Gardens. "The park lies along a heavy migratory path," he said, "and we anticipate attracting the more shy Canada geese when the mallards have become established." Pawley has been working with Meo and others on a voluntary basis for the past three years, aided in the bird feeder project by local ornithologist Isobel Wasson.

"We expect the pond to take a while to catch on with geese," he continued. "At present, no domestic species normally are resident in the area. Canada geese are more hesitant than the mallards in accepting a new locale. They have a greater problem in landing and lifting off in a water area and are generally much more conservative in their behavior patterns."

The location of the sanctuary is unique, just half a block from busy Lake Street and right next to the giant new Village Mall shopping center, which opened in November. Landscaping has been creatively designed to buffer the park from these activity areas. Children and adults attend nature study programs developed by the park district in a pool of quiet that seems miles away from the center of town.

Certainly this is an admirable illustration of creative and dedicated planning which changed what might have been just another urban green space into a shaded sanctuary for animals, plants—and humans. The environment in the shadows of our cities needs to be as thoughtfully cared for as does the stretch of Sierra wilderness. There is a simple lesson to be learned here. If each community of similar size in the United States were to establish its own "postage-stamp" wildlife haven, the total outlook for many plant and animal species that now seem threatened, could be much improved. □

Edward E. Ayer Illustrated Lecture Series

The theme for this season's Friday and Saturday Ayer illustrated lecture series is "Expeditions Unlimited 1974-75." Field Museum curators will present slides or films to illustrate their presentations. The Friday programs will begin at 7:30 p.m.; the Saturday programs will begin at 2:30 p.m. All programs will be given in the ground floor lecture hall. Attendance — which is free—is limited to 225 persons. To accommodate those who attend Friday evening programs the cafeteria will remain open on those dates until 7:30. Reservations are not necessary.

February 21, 22 **"The Changing Alaska Eskimo Culture"**
Speaker: James VanStone, curator, North American archaeology and ethnology

February 28, March 1 **"Natural History of Deep Sea Fishes"**
Speaker: Robert Johnson, assistant curator, fishes

March 7, 8 **"The Tunguska Explosion: Meteorite, Comet, or Black Hole?"**
Speaker: Edward Olsen, acting chairman, Department of Geology, and curator, mineralogy

March 14, 15 **"Wet Snails in Dry Deserts"**
Speaker: Alan Solem, curator, invertebrates

March 21, 22 **"Veracruz, Mexico: Green Grow the Lilacs"**
Speaker: Lorin Nevling, chairman and curator, Department of Botany

March 28, 29 **"Frog Ecology in the Congo"**
Speaker: Robert Inger, assistant director, Science and Education

April 4, 5 **"Collecting Mosses in Southern Chile"**
Speaker: John Engel, Richards visiting assistant curator, bryology

April 11, 12 **"Ancient Ecuador: Culture, Clay, and Creativity"**
Speaker: Donald Collier, curator, Middle and South American archaeology and ethnology

OVER THE TOP!

OVER THE TOP!

OVER THE TOP!

It has been the story of dimes and quarters from school children to multi-thousand-dollar gifts from individuals and corporations, but every cent has been equally important in paving the way to a successful climax for Field Museum's Capital Campaign drive. The three-year effort realized a final total of $12,623,925 in gifts and pledges as 1974—and the campaign—came to a happy conclusion. When the campaign reached the $12,500,000 mark it qualified for a matching fund from the Chicago Park District Bonding Authority, resulting in a total amount of more than $25,000,000.

In December, the campaign's final month, 185 gifts were received—from members, Museum staff, foundations, and corporations. Notable among the latter two categories were FMC Foundation; Chicago Community Trust; Borg Warner Foundation; Frederick Henry Prince Trust; and Mark Morton Memorial Fund, whose collective generosity was instrumental in putting the campaign over the top.

Sharing a large measure of responsibility for the campaign's success were four Museum trustees: Nicholas Galitzine (general chairman), Marshall Field (vice chairman), Blaine J. Yarrington (corporations and foundations chairman), and William H. Mitchell (co-chairman with Mr. Field for individual gifts).

The Capital Campaign is now a closed chapter, but the Museum's need for dedicated support is a continuing one, and we must build on the campaign's signal success to maintain and strengthen the Museum's resources as an educational and research institution. Like all institutions that depend upon members for their support, Field Museum has little insulation against inflation and other effects of a troubled economy. The remarkable success of the Capital Campaign, however, demonstrates what Field Museum means to its members and the leadership role to which it is predicated. With your support, we look forward with cautious optimism to the years ahead and what they will bring.

William H. Mitchell

Marshall Field

Blaine J. Yarrington

Nicholas Galitzine

ILLINOIS NATURAL HISTORY
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FEBRUARY at Field Museum

SPECIAL PROGRAMS

Continuing

Craft Demonstrations and Discussions

"Resourceful People: The Use of Available Materials in Different Cultures," 10:00 a.m. to 12:00 noon, Mondays, Wednesdays, and Fridays. Entrance to Hall 27.

"Traditions of Native North America," 10:00 a.m. to 12:00 noon and 2:00 to 5:00 p.m., Fridays. Hall 4.

Weaving demonstration by members of the North Shore Weavers' Guild from 10:00 a.m. to 12:00 noon on Mondays, Wednesdays, and Fridays. Spinning also shown on the first and third Mondays of each month. South Lounge.

FILMS

Free film series, "Ascent of Man," presented at 2:00 p.m. Fridays and Sundays through April 20. All programs will be in the Lecture Hall with the exception of February 9 and 16, which will be in the North Meeting Room.

The one-hour films cover a time span of more than two million years in exploring scientific discoveries that have shaped human history.

Feb. 2: "Harvest of the Seasons"
Feb. 7 and 9: "Grain in the Stone"
Feb. 14 and 16: "The Hidden Structure"
Feb. 21 and 23: "Music of the Spheres"
Feb. 28: "The Starry Messenger"

Sunday, February 9 and 16:

30th Chicago International Exhibition of Nature Photography, a slide show featuring winning and accepted color transparencies, 2:00 p.m. in Lecture Hall.

Free Ayer Adult Illustrated Lecture Series, "Expeditions Unlimited 1975," presented by Field Museum curators at 7:30 p.m. Fridays and 2:30 p.m. Saturdays in Lecture Hall.

Seating is limited to 225 persons. Museum cafeteria is open until 7:30 p.m. Fridays.

Feb. 21 and 22: "The Changing Alaska Eskimo Culture," by James W. VanStone

Feb. 28: "Natural History of Deep Sea Fishes," by Robert Johnson

CHILDREN'S PROGRAM

Through February 28:

Winter Journey for Children, "Cats, the Graceful Hunters," focuses on the differences and similarities of these creatures, from the domestic variety to its larger relatives (lion, tiger, etc.). All boys and girls who can read and write may participate in the free, self-guided tour of Museum exhibits. Journey sheets in English and Spanish available at entrances.

MEETINGS

Feb. 5, 7:00 p.m., **Chicago Mountaineering Club**
Feb. 9, 2:00 p.m., **Chicago Shell Club**
Feb. 11, 7:30 p.m., **Nature Camera Club of Chicago**
8:00 p.m., **Windy City Grotto, National Speleological Society**
Feb. 12, 7:00 p.m., **Chicago Ornithological Society**
Feb. 14, 8:00 p.m., **Chicago Anthropological Society**

COMING IN MARCH

Begins March 1:

Spring Journey for Children, "People of the Salmon and Cedar," a free, self-guided tour, routes youngsters to Museum exhibits relating to the Northwest Coast tribes.

Free film series, "Ascent of Man," presented at 2:00 p.m. Fridays and Sundays in the Lecture Hall.

Mar. 2 "The Starry Messenger"
Mar. 7 and 9: "The Majestic Clockwork"
Mar. 14 and 16: "The Drive for Power"
Mar. 21 and 23: "The Ladder of Creation"
Mar. 28 and 30: "World Within World"

March 8 and 15:

Ray A. Kroc Environmental Education Program presents a two-session course, "How to Identify Fossils and Rocks," from 10:00 a.m. to 12:00 noon.

A non-refundable fee of $4 for members and $6 for non-members covers cost of classes, which are limited to 25 persons, age 16 or older. For reservations mail checks payable to Field Museum, with name, address, and phone number, to Environmental Programs, Field Museum, Roosevelt Road at Lake Shore Drive, Chicago 60605.

Free Ayer Adult Illustrated Lecture Series, "Expeditions Unlimited 1975," presented at 7:30 p.m. Fridays and 2:30 p.m. Saturdays in the Lecture Hall.

Mar. 1: "Natural History of Deep Sea Fishes," by Robert Johnson
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Mar. 14 and 15: "Wet Snails in Dry Deserts," by Alan Solem
Mar. 21 and 22: "Veracruz, Mexico: Green Grow the Lilacs," by Lorin I. Nevling, Jr.
Mar. 28 and 29: "Frog Ecology in the Congo," by Robert F. Inger

Seating is limited to 225 persons. Museum cafeteria is open until 7:30 p.m. Fridays.

Craft demonstrations and discussions

Weaving demonstrations

MUSEUM HOURS

Open 9:00 a.m. to 4:00 p.m. Monday through Thursday, 9:00 a.m. to 9:00 p.m. Friday, and 9:00 a.m. to 5:00 p.m. Saturday and Sunday.

The Museum Library is open 9:00 a.m. to 4:00 p.m. Monday through Friday. Please obtain pass at reception desk, main floor north.

Museum telephone: 922-9410

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Field Museum of Natural History Bulletin

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Field Museum of Natural History Bulletin

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COVER

Phlogiotis helvelloides, a jelly fungus which grows on rotting wood in moist conifer forests. It grows from about 1 to 3 inches tall. The photograph is by Larry C. Moon of Spokane, Washington, and won the Myrtle A. Walgreen Award in the 30th Chicago International Exhibition of Nature Photography, held in February at Field Museum. See pp. 10-11.

Photo Credits

Pages 3, 4, 5: Henry Field; p. 6 (bottom): Elliott Miller; p. 7: John Bayalis; p. 10: Diane Lynne Payton; p. 11: Roy E. Barker; pp. 13, 14, 17 (bottom): D. Walsten.

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A village elder of Sandor

On the Road to Amadiyah

by Elliott Miller

Among the ethnic groups that emigrated to Israel after its founding in 1948 was a tiny group of Jews from Iraq's northern province of Mosul.* In 1934, Henry Field, then Field Museum's curator of physical anthropology, photographed many of these Jews, particularly in the agrarian village of Sandor, as part of his study of the peoples of Kurdistan—an area about the size of Alabama that ranged over eastern Turkey, northern Iran and Iraq. Sandor was located at the southern foot of the Iraqi-Kurdish mountain range, on the road to the city of Amadiyah.

Field also photographed Muslims, Orthodox Christian Nestorians and Armenians, Catholic Chaldeans and Jacobites, and Yezidis, the so-called "Devil-worshippers." These, together with several hundred photos taken in the 1920s by Anne Fisher—an acquaintance of Field's—number about 4,700. Fisher had photographed various peoples and regions of Iraq for an essay, "Your Beautiful Iraq," for Iraq's King Faisal. Together, the two collections comprise an important record of physical types indigenous to Kurdistan of that period.

The bulk of the Field photos are front, back, and profile views which were to have been used in anthropometric studies; but most of Fisher's work as well as a large number of Field's photographs depict casual scenes of daily life in the village. Many of them, like genre paintings, evoke a distant, historic charm, now vanished from that corner of the earth.

According to their own oral traditions, the Sandorites and other Kurdish Jews are the descendants of the Lost Tribes of Israel—those taken into exile by the Assyrians in 722 B.C. If remnants of the Lost Tribes did in fact survive today, it is most likely that they would be

**About 18,000 to 20,000 Kurdish Jews emigrated to Israel during the first half of the twentieth century.*

Elliott Miller is a research associate at the Spertus Museum of Judaica, in Chicago, and a specialist in archaeology of the Near East. He recently served as an intern in anthropology in a program offered jointly by Field Museum's Department of Anthropology and the University of Chicago.

The village of Sandor as it appeared in 1934

Many of Sandor's male inhabitants posed for Henry Field's camera in front, profile, and back views. The closely shaven head and the sidelocks were characteristic of Kurdistan Jews.

found in Kurdistan. Sandor was located just north of the ruins of Nineveh, capital of ancient Assyria. "...the king of Assyria carried Israel away unto Assyria, and put them in Halah, and Habor, on the river of Gozan..." (II Kings 18:11).

In those days both Assyrians and Israelites—exiled in Mesopotamia—spoke dialects of Aramaic, the lingua franca of the Near East. In most places the language was replaced by Arabic during the spread of Islam in the 8th century A.D.; but in geographically isolated Kurdistan, Aramaic was able to survive—even into the 20th century.

An unbroken heritage of Sandor, which dates back to pre-Islamic times, was its dependency on the soil. Indeed, the great majority of the villagers relied upon agriculture for their livelihood. In this respect Sandor was most unusual, for during the Middle Ages, Jews in Christian and Islamic countries gênerally turned to commerce and the trades; but because of their geographic insularity, the Kurdish Jews remained close to the land, as had their forefathers They raised beans and other vegetables, melons, pomegranates, grapes, and figs; and took them to larger towns, such as Mosul, to be sold at market; or the produce was taken from village to village to be sold or traded.

Sandor, a community of about 70 families comprising perhaps 300 individuals, was unique in that it was mostly Jewish. In other Kurdish communities, such as Amadiyah or Zacho, Jews existed as minorities or they occurred in small numbers in agricultural settlements. Prior to the late 1930s a few Muslim families had lived in Sandor, but their land was then bought by the Jewish residents and the Muslims moved out of the village.

This land acquisition illustrates still another unusual feature of Sandor: its inhabitants were free landholders. Elsewhere in Kurdistan, Jewish farmers were usually sharecroppers; or, more correctly, they were serfs on land that was owned by the local agha, or Kurdish tribal chief. In return for the agha's protection against raids by hostile tribes, the Jews were obliged to work in his field, sometimes for pay, sometimes gratis. Sandor, on the other hand, annually gave the agha of Amadiyah a symbolic gift only, such as a finely woven shirt. This gift was in lieu of the land tax to which the agha was traditionally entitled from everyone within his domain. It was only after the unrest caused in 1941 by Rashid Ali, then Iraq's pro-Axis head of state, that the Sandorites bribed a government official so they could bear British arms

for self-defense. We have no evidence that Sandor was ever owned or controlled by an agha.

The independence of Sandor as a Jewish village was reflected in its political structure. It had a Jewish mayor—generally a *hakham,* or wise man, who was responsible for keeping law and order in the community. This was customarily done by means of group sanction—a particularly effective method of punishment in small communities. An example of such group sanction in Sandor was the manner of dealing with those who continually transgressed the Sabbath. The offender was threatened with *herem,* or temporary excommunication. While in *herem* the offender could not attend the synagogue; nor could he speak to others, or they to him. When he had finally repented, the offender was made to lie prostrate across the threshold of the synagogue to allow other members of the congregation to step over him. Only after this could he resume his normal role in the community.

A Sandor hakham, *inside the village synagogue, holds a silver-embossed* tik, *which contains the* torah, *the village's most precious possession.*

In 1951 the entire population of Sandor immigrated to Israel. In the quarter-century since that exodus, the process of acculturation and integration into the new Israeli society had modified customs and traditions which remained unchanged for hundreds of years. Last summer I visited Israel to observe how this tiny group of immigrants had withstood the rigors of "transplantation," and in what ways they were being acculturated. I carried with me a number of the photos that had been taken of the original village and its residents four decades earlier by Henry Field. The response elicited by these photos when I showed them to the villagers was not to be believed! Many of the photos showed mothers, fathers, brothers, and sisters

Sandor villagers in typical dress. Their dress was indistinguishable from that of other Kurdish peoples.

long since deceased. Frequently the viewer would clutch the photo with trembling hands and kiss it fervently. Needless to say, I returned to Chicago minus many old photos.

The Jews of Kurdistan are not the only ethnic group of that region to uproot itself and move to another part of the globe. Many Kurdish Chaldeans and Nestorians, for example, also left their homeland; and Chicago is now home for a large and growing population of Kurdish "Assyrians," as they choose to be called. These people traditionally regard themselves as descendants of the ancient Assyrians—a claim disputed by most scholars.

Currently I am working with these Chicago Assyrians, who live on the far North Side, as I did last year with the Jews who emigrated to Israel—interviewing them and recording aspects of their lives that have undergone cultural change. One of these Assyrians was a *qa'im-maqam,* or Iraqi district governor, whose district included Sandor. The personal accounts of this man relate interestingly to accounts which I had collected earlier from my Israeli informants.

Other Kurdish communities, too, are rapidly disappearing; whether through assimilation—as in the case of the Mandeans; through genocide—practiced early in the century against the Armenians by the Turks; or by the process of emigration, as with the Jews and Chaldeans. For other anthropologists concerned with cultural change, the 4,700 Fisher and Field photos will continue to be an invaluable facility, as they have been for my studies. They give a penetrating, backward glimpse into cultures that have already largely vanished into history. □

◄ Top: *Field Museum curator Henry Field* (center), *takes his ease on a Euphrates boat during his 1934 visit to the Near East.*
Bottom: *Hakham Moshe Sandori ben Ivadia, the scribe and schoolteacher of Sandor, and one of the author's informants. Superstition was an important element in Kurdish daily life, and for centuries the Hakham was the village's main practitioner of the occult arts. He wrote amulets—cabalistic formulae on parchment which were worn in silver cases. Such amulets were thought to protect one against the evil eye and against disease. Even today, in Israel, Hakham Moshe still writes these amulets for those who believe in their power. His main occupation, however, is making torahs, to be placed in synagogues.*

field briefs

Hollow ceramic figurine of man with painting on face and body. Ht. 11½". Circa 600 B.C. On view in an exhibition of ancient Ecuadorian pottery and artifacts, opening April 18 in Hall 9.

Former Curator Knighted

J. Eric Thompson, a research associate in the Department of Anthropology and formerly assistant curator of middle and South American archaeology, has recently been made a knight of the British Empire by Queen Elizabeth II. Sir Eric is one of the greatest living Maya scholars and is the author of many research monographs and books published by Field Museum, the Carnegie Institution of Washington, and the University of Oklahoma Press. His most widely read works are *Maya Hieroglyphic Writing, an Introduction, The Rise and Fall of Maya Civilization, Maya History and Religion,* and *The Civilization of the Mayas;* the latter work was first published by Field Museum in 1927.

Sir Eric lives and continues to write in Essex, England, not far from Cambridge. He was last at Field Museum in 1967, when the Women's Board honored him with a luncheon in celebration of the fortieth anniversary of the first printing of *The Civilization of the Mayas.*

Grove Named Texas Museum Director

Sam Grove, a member of the Department of Exhibition staff since 1947, resigned February 1 to accept a position as director of the Museum of the Southwest, in Midland, Texas. Grove's most recent post at Field Museum was as senior scientific illustrator.

Gentry Named Associate Curator

Johnnie L. Gentry, Jr., who joined Field Museum's Department of Botany in 1969, has been named associate curator, vascular plants. Gentry's main areas of research currently include the Solanaceae (tomatoes and allies) and Boraginaceae (borage and allies), particularly of Central America. Dr. Gentry is also community professor of environmental science at Governors State University, Park Forest South.

Ancient Ecuador Pottery Exhibition Opens April 18

"Ancient Ecuador: Culture, Clay, and Creativity"—an exhibition of pottery and artifacts dating from 3000-300 B.C., opens April 18 in Hall 9. The collection contains material revealing various aspects of the lives of these people and includes the oldest known developed ceramics in the Western Hemisphere, never previously exhibited. Most beautiful are the pottery sculptures depicting humans and animals. Label copy for the display is in Spanish and English. Following its closing at Field Museum on August 5, 1975, the exhibition will travel to other United States museums and to Quito and Guayaquil, Ecuador.

African Arts and Crafts Presentation

Through the end of June, Phillip Cotton, crafts instructor for the Department of Education, will be giving presentations of African arts and crafts. Using Harris Extension learning materials, he will show slides and demonstrate musical instruments and weaving techniques. Children will have the opportunity to sit down and try weaving for themselves. Presentations are on Mondays, Wednesdays, and Fridays, 10 a.m. until noon, in Hall 27.

Federal Grants in 1974

Federal grants to Field Museum's scientific staff in 1974 totalled $253,818. The funds, earmarked for specific research, were provided by the National Science Foundation, National Aeronautics and Space Administration, the U.S. Department of Interior, and the National Endowment for the Arts. Among the projects funded are floristic field work in Central America; the floras of Guatemala, Costa Rica, and Veracruz; and the study of endangered land snail species of the Pacific islands.

LETTERS

Sirs:

The article by David Young in the January *Bulletin* repeats the usual belief that *Brachiosaurus* was the largest dinosaur. In 1969 I pointed out (*Copeia*, pp. 624-626) that the sauropod *Antarctosaurus giganteus*, known from the late Cretaceous of Argentina, may have been as large. Its femur, 2.31 meters long, is the longest known limb bone of a vertebrate. Other bones are both longer and shorter than the corresponding ones of *Brachiosaurus*.

A better comparison would use the sum of the minimum cross-sectional areas of the limb bones, for these carried the weight. A visitor to the Museo de La Plata (La Plata, Argentina) could perhaps make the appropriate measurements for *Antarctosaurus*. The largest known specimen of *Brachiosaurus*, if it still survives, came from Madagascar and it is the Geologisch-Palaontologisches Institut of Humboldt University, East Berlin. It too is inadequately described.

However, there are few specimens known of each genus, and which genus has the largest known specimen may be as much a result of the chances of sampling as of the size each reached in life.

Leigh Van Valen
Department of Biology
The University of Chicago
Chicago, Illinois

"Man Uses the Land"

The Ray A. Kroc Environmental Education Program

April 5 through June 14

Farms or factories? Prairies or parking lots? Recreation or preservation? How shall we use the land?

The Ray A. Kroc Environmental Education Program for Spring, 1975, will focus on land use in the Chicago region. Programs will explore areas of current concern, innovative experiments, and future problems. Activities include field trips for adults, one-day workshop-field trip combinations for families, a series combining field trips and a workshop for teachers, and two courses for photographers.

ADULT FIELD TRIPS

All adult field trips will leave Field Museum north parking lot at 9:00 a.m. regardless of weather. Reservations will be confirmed in order of receipt of coupon and payment by mail only. A nonrefundable fee, $5.00 for members and $5.00 for nonmembers, to cover lunch and transportation, holds advance reservation. Each trip is offered on Saturday and repeated on Wednesday. Saturday adult trips are limited to three trips per person. There is no limit on Wednesday trips.

Energy, Residence, and Recreation Systems

Lakeshore priorities for energy, recreation, and community living will be explored. Indiana Dunes National Lakeshore and Northern Indiana Public Service Company. Leader: Matthew H. Nitecki, Field Museum.

Saturday, April 19; Wednesday, April 23

Looking at Landscapes

Preserving natural communities becomes more difficult as suburbia grows. Morton Arboretum and George Williams College. Leaders: Richard Wason and George Ware, Morton Arboretum.

Saturday, May 3; Wednesday, May 7

Farm Futures

Life on suburban farms caught in the rural and urban interface. Kane County Farms. Leader: Phil Farris, University of Illinois Cooperative Extension Service.

Saturday, May 10; Wednesday, May 14

Guarding the Future

Forest preserves try to balance the often conflicting needs for recreation and preservation. Crabtree Nature Center. Leader: Charles Westcott, Cook County Forest Preserve.

Saturday, May 17; Wednesday, May 21

Challenging Changes

Garbage plus gravel makes a ski hill and an abandoned railroad right-of-way becomes a nature trail. Illinois Prairie Path and Blackwell Preserve. Leaders: Dan Griffin, DuPage Forest Preserve, and Bobbie Lively, Prairie Path.

Saturday, May 24; Wednesday, May 28

Creating Diversity

A native prairie is threatened by development, and an overused forest preserve is transformed into an environmental education center. Wolf Road Prairie and Fullersburg Woods Nature Preserve. Leaders: Phil Hanson, Field Museum and Save the Prairie Society, and Wayne Lampa, DuPage Forest Preserve.

Saturday, May 31; Wednesday, June 4

ADULT COURSES

Each course will consist of four lectures and two field trips. A nonrefundable fee, $14.00 for members and $18.00 for nonmembers, holds advance reservation and covers all expenses except film. Field Museum, North Meeting Room 2nd floor, at 9:30 a.m.

Nature Photography

First session in a series of six, to be continued on successive Saturdays, April 12, 19, 26; and May 3, and 10. The course will cover basic problems of nature photography; exposure, focus, film lighting, close-ups, composition, and trouble shooting. It is designed for amateur photographers who have some knowledge of photography and have access to the use of a single lens reflex camera. The course is limited to 40. Project director: William Burger, Field Museum.

Saturday, April 5

Landscape Photography

First session in a series of six, to be continued on successive Saturdays, May 17, 24, 31; June 7, and 14. An aesthetic approach to nature. Landscape as visual environment; landscape in art; landscape photography in practice. Participants must be seriously interested in scenic photography, be proficient in color, and have a full-frame 35mm or larger format camera. The course is limited to 25. Leader: Charles F. Davis, landscape photographer.

Saturday, May 10

PROGRAMS FOR TEACHERS

An Introduction to Community Ecology

A series, consisting of four field trips and a museum workshop, will explore communities reflecting both urban and natural ecology. Resource materials, field techniques, and ideas for organizing and conducting school field trips will be presented. Teachers may enroll in individual trips or the entire series. Limited to 30 per trip. A nonrefundable fee for the entire series, $22.00 for members and $27.00 for nonmembers, holds advance reservation and covers lunch and transportation for field trips. See following descriptions for individual program fees. Leader: Jim Bland, Field Museum.

The Dunes

Ecological succession, field techniques and National Park facilities will be stressed. Nonrefundable fee of $5.00 for members, $6.00 for nonmembers. Trip leaves the Field Museum north parking lot at 9:00 a.m. regardless of weather. Indiana Dunes National Lakeshore. Leaders: Indiana Dunes National Lakeshore Staff.

Saturday, April 19

The Vacant Lot

Explore the kind of community most accessible to the urban school. Nonrefundable fee of $5.00 for members, $6.00 for nonmembers. Trip leaves field Museum north parking lot at 9:00 a.m. regardless of weather.

Saturday, April 26

The Stream

Participants will get their feet wet observing the varied character of Saw Mill Creek. A rigorous trip with climbing and hiking. Nonrefundable fee of $5.00 for members, $6.00 for nonmembers. The trip leaves Field Museum north parking lot at 9:00 a.m. regardless of weather.

Saturday, May 10

The Lake

A slide presentation on the history and problems of Lake Michigan will be followed by dipping a net into Burnham Harbor. A nonrefundable fee of $2.00 for members and $3.00 for nonmembers. Participants will meet at Field Museum north door desk at 10:00 a.m.

Saturday, May 17

The Prairie

An opportunity to explore Wolf Road Prairie, endangered remnant of the prairie that once covered two-thirds of Illinois. A nonrefundable fee of $5.00 for members, $6.00 for nonmembers. The trip leaves Field Museum north parking lot at 9:00 a.m. regardless of weather. Leaders: Save the Prairie Society members.

Saturday, May 24

FAMILY FIELD TRIPS

Trips leave Field Museum North Parking Lot at 9:00 a.m. regardless of weather. A nonrefundable fee of $5.00 per adult member, $6.00 per adult nonmember and $3.00 per child, holds advance reservation and covers lunch and transportation Reservations are limited to 40 and will be confirmed on receipt of check. Children must be accompanied by adult(s) for these family programs.

The Farm

A visit to an operating hog farm and dairy farm and an opportunity to talk to farmers about their lives and problems. Minimum age: 6. Leader: Phil Farris, University of Illinois Cooperative Extension Service.

Saturday, May 17; Saturday, May 24

The Forest

Explore a pond, a forest, and other ecological communities in Palos Park. Minimum age: 6. Leaders: Harry Nelson, Roosevelt University, and John Wagner, Kendall College.

Saturday, May 31; Saturday, June 7

FAMILY MINI-COURSES

A workshop in the museum plus a field trip. Children must be accompanied by adult(s). A nonrefundable fee of $5.00 per adult member, $6.00 per adult nonmember and $3.00 per child to cover lunch and transportation, holds advance reservation. Reservations will be confirmed in order of receipt of check. Limited to 40.

Here Today, Gone Tomorrow?

An introductory museum program in the morning is followed by a trip to Lincoln Park Zoo in the afternoon to see endangered animals. Minimum age: 8. Meet at Field Museum north door desk at 10:00 a.m. Leaders: Betty Deis, Field Museum, and Saul Kitchener, Lincoln Park Zoo.

Saturday, April 12; Saturday, April 19

Energy: Planning for the Future

Family use of energy will be explored in a museum workshop. Field trip to Bethlehem Steel Plant. Minimum age: 14. Meet at the Field Museum north parking lot at 8:00 a.m. Leader: Katherine Krueger, Field Museum.

Wednesday, April 23

This program is made possible by the Ray A. Kroc Environmental Fund, established at Field Museum by his friends to honor Mr. Kroc, Chairman of McDonald's Corporation, on his 70th birthday. Other events of this program will be presented in coming months and years.

For further information call Lorain Stephens, 922-9410, ext. 360 or 361.

30TH CHICAGO INTERNATIONAL EXHIBITION OF NATURE PHOTOGRAPHY

The Nature Camera Club of Chicago and Field Museum have again sponsored one of the most important and widely acclaimed exhibitions in the world of photography: the thirtieth annual Chicago International Exhibition of Nature Photography.

The competition annually draws color slides from virtually every corner of the world. This year more than 3,000 entries were submitted by 740 amateur nature photographers. About 600 slides were selected by the judges for public viewing February 9-16.

The photo reproduced on this month's *Bulletin* cover, *"Phlogiotis helvelloides,"* by Larry C. Moon, of Spokane, Washington, was recipient of the Myrtle R. Walgreen Award for the best illustration of plant habitat. The two photos shown on this and the facing page were among those receiving honorable mention. "Coming in for the Pollen" (reproduced on p. 10), by Diane Lynne Payton, of Lewiston, New York, was one of eighty attempts by Miss Payton to capture on film the bee about to alight on the flower. "Early Morning Mists" (above) is by Roy E. Barker, of Santa Fe, New Mexico.

The Amateur Fossil-Hunters

Paleontology's Unsung Heroes

by Eugene S. Richardson, Jr.

Sometimes, when professional paleontologists gather in safe little knots at a geological convention, they assure each other that they are the ones who have been entirely responsible for the progress of paleontology. But this oversimplifies. There are two kinds of paleontologists; those who make a living at it, and those who make a hobby of it. Both kinds, let me add, pursue paleontology because they enjoy it.

Many an amateur, over the past century and more of American science, has given great assistance to the study of prehistoric life. They have discovered rare specimens; they have prepared and catalogued and preserved; they have loaned or donated their specimens for study. In show business, such valuable auxiliaries are called "angels." I am on the side of the angels. Let me tell you about a few of them.

There is no catalog or monograph on these generally unsung people. No one can say who are the Grand Champion Amateur Collectors. One who must merit some such title is:

Ralph Dupuy Lacoe 1826-1901

The family name was originally Lecoq, from the north of France. When Ralph's father came to settle in the anthracite country of northeastern Pennsylvania, and to set himself up as a carpenter there, the name somehow changed its form. He married the daughter of another French family, Dupuy, who, fleeing an insurrection of slaves on the West Indian island of Hispaniola, had settled on forested land nearby. Ralph, the youngest Lacoe son, attended a country school and learned carpentry from his father. For Ralph's later intellectual interests his biographer gives credit to his mother rather than to his schoolteacher—justly, I'm sure.

While making his way up in the world as a carpenter, young Lacoe cut timber on his grandfather Dupuy's land and filled orders for railroad ties as the country developed. He invested the income from the railroad ties in coal lands in the developing Lackawanna anthracite field. He knew how to recognize which tracts would have coal under them. Soon, he branched out into other enterprises: trading in real estate, manufacturing, banking. But by the time he was 41, just after the Civil War, his health broke from overwork and he took a vacation to Florida.

While recuperating, Lacoe collected shells on the Florida shore, and for the first time he became interested in natural history as a hobby. His health never returned, and he gradually lost his hearing, which rather cut him off from normal relations with other people. But he lived another 35 years, attributing his long life to his happy outdoor pursuit of fossils. For on his return to Pittston, where there were no seashells to pick up, he began to collect local fossils, principally the plants associated with the coal.

Soon, he was not only collecting but also studying what he had, and in time he built up one of the four or five finest paleontological libraries in the country. In order to use this library best, he learned French and German. Studying his fossil plants and their geologic occurrence, Lacoe corresponded with J.P. Lesley, the state geologist, and with Leo Lesquereux, the great paleobotanist, of Columbus, Ohio, who became his close friend. From the home town area, his collecting trips expanded. Before long, he was adding Mississippian and Devonian plants as well as Pennsylvanian, and was going as far afield as the southern and midwestern states. Always he met local collectors, and with increasing frequency he bought specimens from them, or even hired them to collect for him after he went back home. His travels widened. He went to Europe, where he traded some of his Pennsylvanian plants for local fossils—and again bought specimens. He went to the Rocky Mountain states and expanded his collecting to include younger fossil plants—Permian, Mesozoic, and Tertiary. Occasional animal fossils were associated with the fossil plants, and soon Lacoe was particularly interested in acquiring fossil insects and myriapods (an invertebrate group that includes centipedes and millipedes), and somewhat later, crustaceans, fishes, and molluscs as well.

Many years later, Professor Charles Schuchert wrote:

> Until recently, but one locality in the United States yielded specimens of Paleozoic insects in numbers sufficient to warrant collectors to look for these rarest of fossils. This locality is along Mazon Creek, in Grundy County, Illinois. Mr. Daniels tells the present writer that about one insect is found to every thousand concretions, and were it not for the splendid plants and the rare invertebrates found inside the other 999 nodules no collecting at all could be done. For many years Mr. Lacoe offered a premium for every nodule containing an insect, arachnid, or myriapod, and eventually he was enabled to assemble 70 insect-bearing concretions.

Crown of a crinoid, Taxocrinus colletti, *collected near Crawfordsville (Montgomery County), Indiana.*

Eugene S. Richardson, Jr., is curator of fossil invertebrates.

> In the plant-bearing shales of the anthracite and bituminous regions, Mr. Lacoe occasionally secured a single insect wing, and when the finds became sufficient to warrant digging for them he would specially detail a collector to examine the shales of a given locality. Rarely did such work yield more than a few insect wings each day, but after long perseverance about 625 specimens were collected.

Lacoe's collection was his chief interest, but it generated another interest, science. With his extensive library and his correspondence, he had already become as knowledgeable in his chosen field as any professional. Now he perceived the value of this collection to the broader community. Professor Rollin Chamberlin has written:

> Realizing the very great handicap to the progress of paleontology due to the enormous labor and expense of discovering, exhuming, and intelligently preparing the fundamental materials from which the paleontologist must work out his results, he chose for his first service to science the task of securing this material and properly placing it in the hands of paleontologists.

He sent specimens to specialists for study—plants to Lesquereux, millipedes and insects to Samuel H. Scudder at Harvard, amphibians and reptiles to Edward Drinker Cope in Philadelphia, molluscs and brachiopods to James Hall of Albany, crustaceans to Alpheus Packard at Harvard. These eminent scholars studied Lacoe's specimens, described new species, and returned the specimens. Before his death, his collection included 575 types—specimens described or illustrated in the published literature of paleontology. Not infrequently, Lacoe provided a subsidy for the work, and paid for handsome illustrations.

Although he gave a large number of specimens to the State of Pennsylvania, forming the most important part of the study collection of the state geological survey, his collection continued to grow. By 1891, it filled the entire upper floor of his National Bank building in Pittston, a first-rate scientific resource, though little known to his neighbors. But the Pittston Bank building was not fireproof, and this worried Lacoe. Here was his collection, perched above a lot of inflammable dollar bills. He decided to transfer his records and his specimens to the United States National Museum, in Washington.

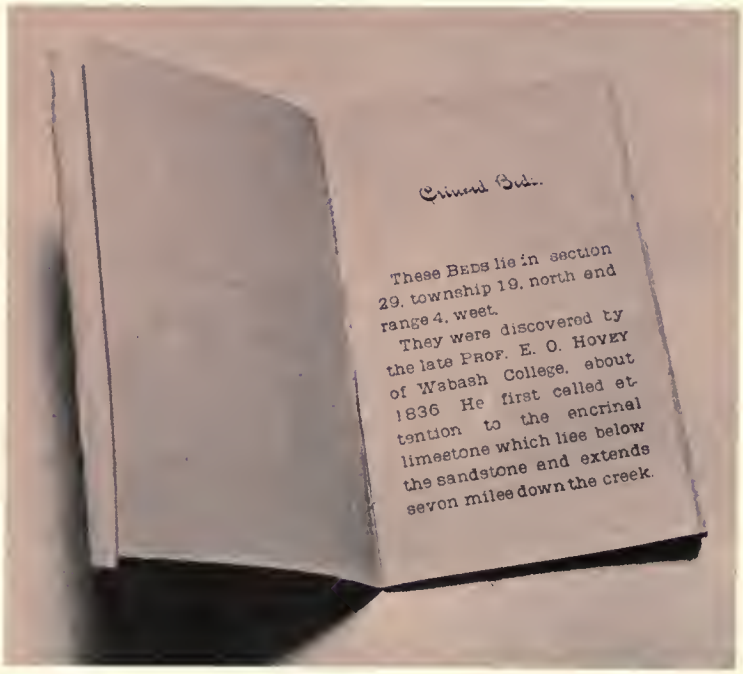
In 1895, Lacoe sent 315 boxes of labeled and catalogued plant and fish fossils to Washington, followed four years later by his fossil insects, myriapods, and crustaceans. A few months later, still making plans to collect more fossils, he died. His collection remains one of the acknowledged treasures of the United States National Museum.

Lacoe became a collector because at the time his interest was sparked he lived within ready reach of collectible fossils; he became an important collector because of his intellectual qualities and his financial resources—and, if you will, because of a sense of mission.

Other areas have inspired collectors by the ready availability and elegant preservation of the local fossils. In the United States, such areas are too numerous to list. A few examples must serve.

The Crawfordsville Collectors

The pleasant town of Crawfordsville, Indiana, is built upon a dark blue-gray mudstone of Mississippian age, firm enough to stand as cliffs or steep banks where Sugar Creek, Indian Creek, and their tributaries have cut deep valleys. Occasional beds of limestone, some of them several feet thick, are composed almost entirely of the stem plates of crinoids, (a class of marine invertebrates commonly called sea lilies), and in the mudstone itself are found countless specimens of the intact crowns of crinoids. Crawfordsville may be a county seat (Montgomery County) and an educational, industrial, and business center, but to paleontologists it is known for crinoid crowns. They were being collected as early as 1836—by Edmund O. Hovey, one of the two instructors at newly established Wabash College. Hovey counts as a professional; let us ignore him. But it is of record that in 1842 his 9-year-old son, Horace, surely not a professional, responded to an advertisement of a New York collector by shipping east a bushel of crinoid stem plates, for which he was paid $5. I know of no other instance of anyone expressing a desire for a bushel of crinoid stems. Other early collectors of Crawfordsville crinoids included Orlando Corey, a locksmith; Daniel Bassett, a minister; and a host of little boys and young teenagers. One of the boys, Charles Beachler, printed by hand a small book on the Crawfordsville crinoids when he was 15 years old. Complete with misprints, this little book powerfully evokes the picture of an earnest lad diligently setting type in the shop of a friendly job printer. Young


Crinoid Beds.

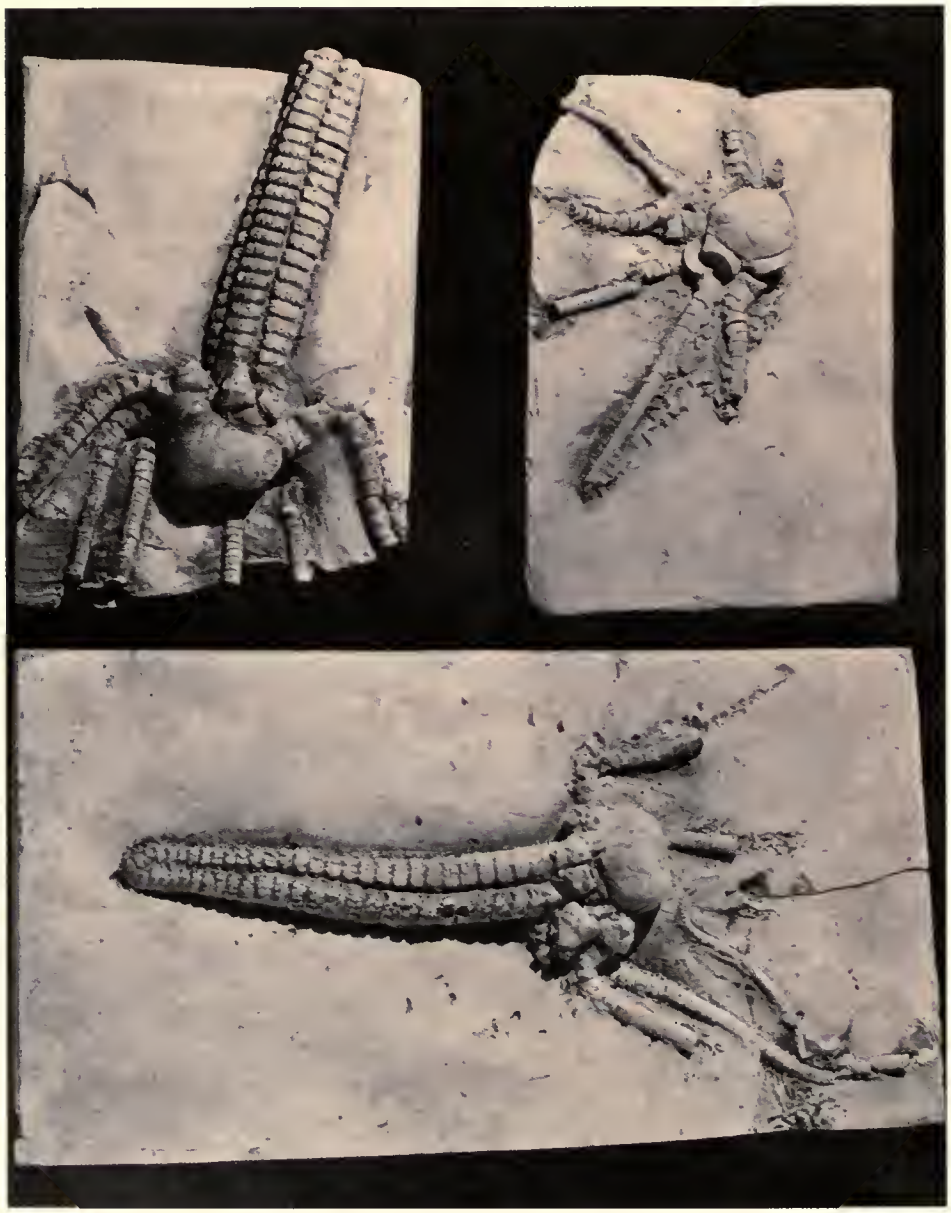
These BEDS lie in section 29. township 19. north and range 4. weet.

They were discovered ty the late PROF. E. O. HOVEY of Wabash College. about 1836 He first called attention to the encrinal limestone which lies below the sandstone and extends sevon milee down the creek.

Opening pages of History of the Crinoid Beds of Crawfordsville, Indiana, 1836-1886, *written by Charles Beachler at the age of fifteen and published by him in 1886. He handset the type and printed the entire booklet himself.*

Charles sent out the whole edition, free, to paleontologists; in the Field Museum library is the copy that he sent to James Hall, with Hall's notation that he had acknowledged it. The following year, Charles turned out a second edition, somewhat enlarged and with different misprints, for which he asked ten cents. Charles Beachler was certainly an amateur at this early period. For a while he collected crinoids for Frank Springer, a collector who hired him, and for one season he was an assistant on the Geological Survey of Georgia. He would have gone on to a professional career, but he died at the age of 23.

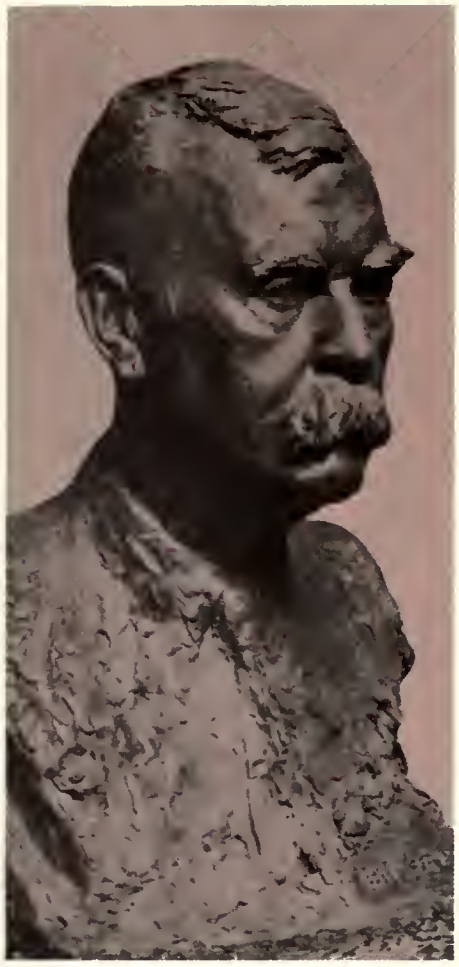
The important point that I would make about the group of amateurs in Crawfordsville is not so much that they collected, preserved, and distributed the elegant fossil crinoids from their blue-gray mudstone, important though that is, but that there was a climate of common interest in which a small boy could discover, develop, and pursue paleontology to the point where it would become his career. The three small papers published by Charles Beachler in his short life—not counting those little hand-printed books—were good papers, still referred to, and presaged a distinguished career that didn't come about.



The Cincinnati Collectors

Even more than Crawfordsville, Cincinnati has long been a spawning ground for paleontologists, most of whom began as youngsters to collect the elegantly preserved brachiopods, bryozoans, and other Late Ordovician fossils from the limestones and shales abundantly exposed in and near the city. The names of E. O. Ulrich, Charles Schuchert, R. S. Bassler, S. A. Miller, Nathaniel Shaler, E. W. Claypole, Carl Rominger, John Nickles, John Locke, August Foerste, U. P. James, and J. S. Newberry are well known, and include some of the nation's most renowned paleontologists. At the present time, there is an organization of amateur collectors in Cincinnati, known as the "Dry Dredgers"; the members maintain a close working relation with Professor Kenneth Caster of the University of Cincinnati, and have been responsible for several significant discoveries. For many years, the Cincinnati Society of Natural History and its museum have played a similar role in the liaison of amateur and professional. Among the specimens in the Field Museum are a few hundred Ordovician fossils accompanied by labels printed "QCNH Society." These came from the personal collection of Charles L. Faber, another Cincinnati collector. Tentatively, I suppose that the cryptic initials mean "Queen City Natural History" Society, Queen City being an alternative name for Cincinnati, but I have found no record of such a society. Perhaps Faber was the only member. Samuel A. Miller, a lawyer, was one of the group I have mentioned who retained his amateur status, though he published numerous papers describing his fossils. Toward the end of his life Miller unfortunately fell prey to a disease that required alcoholic medication. In that period, other collectors found that they could trade fifths or pints for fossils, and Miller's collection was dissipated in several directions.

Three specimens of Aesiocrinus magnificus *in the Field Museum collection. William Gurley traded a "petrified frog" for specimens of this crinoid.*



Frank Springer. Bronze bust by C. Scarpitta, presented to the state of New Mexico by friends of Springer.

The Richmond Collectors

Richmond, Indiana, like Cincinnati, is built on highly fossiliferous Late Ordovician rocks, and many collectors have dwelt there. Among the specimens at Field Museum are several hundred of these Richmond fossils, marked in delicately inked numbers on tiny white paper rectangles pasted to the specimens. This was the collection of Mary P. Haines, wife of Joshua Haines, of Richmond, and each number corresponds to a precisely written entry in a catalog that still exists, a hundred years after it was made. Mary Haines was a Quaker housewife unknown to history, but a woman of broad interests. Packed in a small box with some of her daughter's German lessons are several letters from her friends, including one from a lady in California which enclosed a fern still sound enough to be transferred to the Museum's herbarium. I like to think of the Haines Collection as an example of a collection made and treasured for its own sake, forming perhaps a window to a wider world for a quiet lady in a quiet community.

Frank Springer 1848-1928

In contrast to Mrs. Haines, let me refer briefly to a man who wrote 58 books and scholarly papers on fossil crinoids. Forty-seven years later, these are still fundamental references in the study of crinoids, and it is always something of a surprise to remember that their author, Frank Springer, was a lawyer. To be sure, he was a paleontologist too, though in no sense a professional.

Frank Springer was born about thirty miles from Burlington, Iowa, which even then, in 1848, was known for its abundant and beautiful Mississippian crinoids. He collected them as a boy, but his education was directed toward the Law, a profession that he followed with distinction. Soon after joining the Iowa bar, he moved to New Mexico—"to grow up with the country," as he said. But he returned each summer to Burlington and its crinoids. Like Ralph Lacoe, Springer attributed his long life to the outdoor recreation and the pleasurable relaxation of collecting, an important matter since he was troubled with repeated heart attacks in his last twenty years. Again like Lacoe, Springer employed collectors to increase his collection, and among these was teenage Charles Beachler of Crawfordsville, the lad who had printed the little books. And—again like Lacoe—when the collection had become large and obviously important, Springer gave it to the United States National Museum, where it arrived in 1911, the 100,000 specimens having travelled across the country in a specially cushioned boxcar. The Springer Collection, supported by an endowment donated by Springer, is another of the chief paleontological treasures in the possession of the nation.

One would not, surely, apply the term "amateur" to one who published sixteen important papers on fossils, who became the first curator of the Illinois State Museum, the second state geologist of Illinois (both in 1893); and curator of the University of Chicago's Walker Museum (1900). But even professionals begin as youngsters. One whose early years were devoted with unusual vigor to paleontology as a hobby was:

William Frank Eugene Gurley 1854-1943

Gurley was born in upstate New York, the son of a printer named Reed, who died a year later. When his mother remarried, William was given the name of his stepfather, a blacksmith. He was nine years old when the family moved to "the far west," first to Michigan, then to Danville, Illinois, in search of better economic conditions. In time, young Gurley became one of Danville's leading citizens.

As a youngster, he collected stamps, embossed trade marks, Indian artifacts, and other curios, which he carefully arranged in his always well-documented "cabinet." The collecting and minute study of his treasures were almost terminated when he was seven years old: a severe attack of measles left him completely blind for several months. His eyes remained weak, and he was completely blind for his last twenty-five years.

The black shale that caps the Danville coal is exposed where the Vermilion River cuts through bedrock at Danville. The young collector, with the measles safely behind him, was attracted by the gleaming golden pyritized fossils in the velvety black rock. They were so handsome that Gurley soon built up a lively system of exchange with other collectors. He accepted in exchange not only fossils from other localities, but minerals, artifacts, and other attractive items, including, from seafarers in New Bedford, barrels of shells from far exotic places. Receiving fossils in exchange for shells, Gurley then exchanged those fossils by mail with a rapidly widening list of far-flung paleontologists and even institutions. Some sort of a high spot was reached when he traded a collection with the Imperial Royal Geological Society of Austria. As usual, he sent his part of the exchange first, leaving his correspondent to reply with items of equal value. So pleased were the Austrians that at the next annual meeting this sixteen-year-old from Danville was elected a corresponding member, with a handsome engraved certificate as witness thereunto. This was no light matter; at that time the only other Americans on the roll of corres-

ponding members of the Imperial Royal Geological Society were Louis Agassiz, James Hall, Ferdinand Hayden, and Amos Worthen. In 1873 his amateur standing begins to crack; in that year he registered at Cornell, to study geology. Also in 1873, this Illinois freshman was one of the group of founders of the Swiss Paleontological Society.

So far as Paleontology is concerned, he remained an amateur even after graduation. In 1876 he joined the gold rush to Colorado, roaming the mountains with a donkey to carry his packsack. Between episodes of panning or digging for gold, he worked as a weighmaster, a road builder, a carpenter, a printer. He returned to Danville with little gold but many fossils, and there he went to work as a civil engineer, becoming city enginer of Danville. Still building up his fossil collection, he laid out railroad lines in Illinois and Indiana (and held lifetime passes on those lines), bought and sold real estate and insurance and mortgages. Shortly after Gurley returned from Colorado, his first publication appeared, a description of some brachiopod anatomy in the Proceedings of the American Philosophical Society. Having been a printer in Colorado, he was properly disgusted by a misprint in this publication, where his name as author appeared as "Ginley." For some years thereafter, his publications, written in collaboration with the Cincinnati lawyer, Samuel Miller, were privately printed so that he could keep an eye on the typesetting.

Having made a fortune from his engineering and associated interests, Gurley was able to give more and more time to building up his fossil collection, and he could afford to accept the less remunerative geological offices that he later held. Let me climax his amateur period with the tale of how he managed to acquire certain elegant Pennsylvanian crinoids:

When a new road was being built in Saint Louis, the horse-drawn grading equipment cut into a gray micaceous siltstone containing some elegant intact specimens of *Aesiocrinus magnificus* (the name was given to it later by Miller and Gurley—carefully printed). Gurley heard of this find, and had to have the crinoids. He approached the city engineer of Saint Louis, who had glaumed onto the specimens. No; they were not for sale. No; the city engineer of Danville had nothing adequate to offer in exchange. Oh, well, there was one thing—the city engineer of Saint Louis recalled a picture and description of a soapstone Indian pipe in the shape of a frog that had been illustrated in a report of the Indiana Geological Survey. If Gurley could get that pipe for him, the Saint Louis man would trade. Striking while the iron was hot, Gurley immediately posted a performance bond for $5,000 and promised the pipe. Then he set to work to find out where it was, and laid his plans. The pipe was owned by a farmer somewhere in Indiana. One hot summer day, Gurley headed east from Danville by train with a heavy suitcase.

At a stable near the depot in a small Indiana town, he hired a horse and buggy and headed for that farm, where he tapped on the back door. "Howdy," says he; "A mighty hot day. I'm looking for Silas Brown's place." This, as he well knew, was four miles away, down the road he had come. "Dear me; I must have made the wrong turn. Mind if I water my horse?" He led the horse to water and had a nice cold glass of buttermilk in the kitchen himself. "My, those are right pretty seashells on your table. Mind if I look at them?" And conversation followed. Among the treasures of the household, it turned out, was a "petrified frog" that some Indians had hollowed out for a pipe, but the farmer and his wife really preferred their seashells. It just happened that Gurley liked seashells too, and he just happened to have some of his best ones out in the buggy. An hour later the farmer had persuaded Gurley to accept the petrified frog in exchange for the shells. The horse had had a good rest, and cheerfully pulled the buggy back to the livery stable. Back to Danville by train, on to Saint Louis by the first connection, back home the next day, and the crinoids were safe in the Gurley collection.

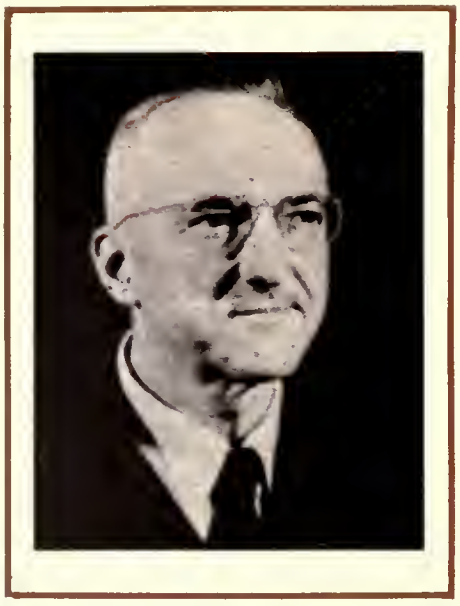
Years later, when Gurley was given charge of the University of Chicago fossil collection, he generously made it possible for the University to acquire his own collection. To this day, we can show you the Saint Louis crinoids and the pyritized shells from the black shale of the Vermilion River, now housed in Field Museum.

Today, more than ever, fossil collecting is a popular hobby and a serious preoccupation of many people. In the Chicago area the name of fossil collectors is legion, most of them concentrating their efforts on the Coal-age fossils from the Illinois strip mines.

It is only because the amateurs devote thousands of man-hours to the job that some of the very rare fossil species have been found. And, significantly, it is only because of their generous cooperation in lending or donating specimens for study by trained paleontologists that these species can ever be made known to science.

It is a long tradition, this hobby and this symbiotic relation of amateur and professional. A collector collects—and this may go no farther than sending a keg of crinoid stems to New York. A true amateur, a lover of his subject, goes farther. He labels and catalogs his collection, like Mary Haines of Richmond. He studies it and reads all he can find on the matter, as did the young William Gurley and Charles Beachler. He may become a first-rate scholar, like Lacoe, or Springer, or Gurley. And, knowing the worth of his collection, he makes provision for its continued existence and care beyond his own time. □

William Gurley



JERRY HERDINA 1905-1974

by Eugene S. Richardson, Jr.

For years—ever since 1928, when the first strip mines were opened for coal in Will and Grundy counties, Illinois—collectors of the Coal Age fossils thrown up in the spoil heaps have observed a tall, slim figure strolling alone across the tortured landscape. Occasionally he would stoop and pick up a red, hamburger-shaped ironstone concretion and stow it in his collecting bag. This was Jerry Herdina, dean of the Chicago-area fossil collectors. Jerry was a "loner," usually collecting by himself, or with his niece and her husband, the Lambert Schriners. But many other collectors have pleasant recollections of a chance meeting in the hills and a subsequent conversation about fossils.

Jerry, a lifelong friend of the Museum, died on November 25, 1974, two months short of his seventieth birthday. One of his last acts was to give his entire collection of fossils to the Museum. It is a collection already well known to scholars in this country and Europe. All but a few hundred of the 14,191 specimens are Pennsylvanian fossils from the strip mines, an area of particular research interest to the Museum.

I frequently borrowed specimens from Jerry for study. In a letter to me in April, 1958, he said, "I hope that this is only the first of many loans of specimens. We hope to get out in the field soon and do some more intensive hunting. It is our ambition to build up a collection of which we may be proud." In this, Jerry and the Schriners succeeded notably. And now that the collection is housed here, it is one of which the Museum is proud.

His parents were Joseph Hrdina, a cabinetmaker, and Marie Benes, his wife, who came to Chicago directly from Bohemia early in this century. They lived first at 25th and Whipple, where Jerry was born on Jan. 25, 1905. In a few years, the family moved to a large frame house on 21st Place near Karlov, in the same neighborhood. Jerry continued to live there for about fifty years, long after the death of his parents, and it was there that I first saw his collection, in 1955. As a boy, Jerry walked a few blocks to the Daniel J. Corkery Grade School, and later to the Carter H. Harrison High School. In one of his schoolbooks, a Spanish grammar, his name is still spelled Hrdina, the correct Bohemian form; he was in his early teens when his father added the vowel as a concession to neighbors who expected one.

In his formative years, Jerry's interests were broad, embracing many aspects of nature. This interest brought him often to the Museum, and later to the Aquarium and Planetarium. He had a speaking knowledge of Spanish and Czech, and a scholar's interest in the local history of Illinois and Utah. Upon graduation from the University of Illinois at Urbana shortly before the depression, he went to work for the Ryerson Steel Company in Chicago as an engineer. The steelwork for many bridges and tall buildings in the Chicago area, including that for Marina City, was fabricated from his calculations. Jerry never married, and devoted his off-hours to the meticulous care of his house and garden, to accumulating a notable reference library, and most particularly to collecting fossils in the strip mines. It was his quiet boast, too, that he had attended every Members' Night at Field Museum.

In 1969 Jerry moved to Berwyn, and it is the immaculate basement of the yellow-brick two-flat that is particularly remembered by paleontologists from Chicago, Harvard, Cal Tech, and European universities. The specimens were all in uniform white pasteboard boxes on steel shelves, arranged by species and locality. It was easy to find them.

Such a large and carefully assembled collection naturally included some unique specimens. In the slow grinding of the mills of science, some of these have been put on record. Two of them, important species new to science, were named for Jerry Herdina during his lifetime. *Herdina mirificus*, a short-winged insect; and *Paleocadmus herdinae*, a nautilus-like creature, embody his name in theirs in acknowledgement of the significance of his collection.

His name also appears on the map of the United States. For years, Jerry spent his annual vacation in southern Utah, prowling about the country that has now become Arches and Capitol Reef national monuments, and Canyonlands National Park. He wandered far from the established trails, charting the way to wonders unknown even to the rangers, and recorded their unspoiled beauty in hundreds of sharp, brilliant, and impeccably composed color slides. Today, a portion of Arches National Monument is marked "Herdina Park" on the National Park Service map in tribute to his volunteer trailblazing.

After Jerry's death, his sister, Mrs. Helen Poncar, gave the Museum, in his memory, all of his books and color slides. Many of the books have found a place in the general library, but most significantly a large number form the nucleus of a new library in the Museum's Department of Education. The 3,539 color slides, all carefully numbered and catalogued, will also be maintained in Education as a valued resource for programs in ecology, geology, and paleontology.

Jerry's many friends on the Museum staff will long remember his friendly interest in their work; and his books, pictures, and fossils will long continue to be actively used, as he meant they should be. □

Herdina mirificus, a short-winged insect discovered by Herdina and named for him.

Eugene S. Richardson, Jr., is curator of fossil invertebrates.

A Taste of Spring

In anticipation of warmer weather and longer days, Field Museum proudly presents A TASTE OF SPRING — a series of three Wednesday evening slide-lectures designed to give members an opportunity to meet informally with curators in a dinner-table atmosphere. The tickets are $7.00 each. Make your reservations now for:

*Frederick R. Schram, associate professor of zoology at Eastern Illinois University and research associate in Field Museum's Department of Geology, takes us on "A Short Journey through the Long Egyptian Past." The monument of man in the Nile Valley extends from before three thousand B.C. to the present and covers the panorama of polytheism, Christianity, and Islam. It encompasses the great pyramids and the Aswan High Dam. An appreciation of Egypt's rich heritage is helpful in understanding current events in the Middle East.

*The many flowers that adorn our Spring woodlands are a delight to the eye, but for the plants that bear them they are not merely cosmetics. William Burger, associate curator of botany, shows us "How Flowers Pay Their Way." We'll see that flowers are an energy investment for the plant and must produce dividends. We'll take a deeper look at their form and function and discover how they go about getting results. A great many flowers representing many different families will be discussed; Dr. Burger will also explain a variety of pollination strategies.

*Edward Olsen, curator of mineralogy, will show us how each day the good old Earth is bombarded by millions of meteors, of which only a few hundred a year make it through to the surface before burning up completely—these are the meteorites. Spring is the time of the year when meteorite falls are at their peak abundance. The oldest solid objects of the solar system, they carry the story of their long and varied history within them. The program will revolve around aspects of meteorite falls, what we have learned from them, recent missions of satellites to other planets, and aspects of current lunar research.

The three above programs are scheduled for 6:30 p.m. for these Wednesday evenings: March 12, 19, and April 2. Reservations will be accepted on a first come, first served basis. Applications should be accompanied by full payment of $7.00 per person, covering dinner and the program. Children twelve years of age and older are invited; guests of members are also welcome.

CLIP COUPON AND RETURN TODAY!

field museum's
wednesday evening
slide lectures

March 12 program:
A Short Journey Through
the Long Egyptian Past
No. of persons attending_____

March 19 program:
How Flowers Pay Their Way
No. of persons attending_____

April 2 program:
Showers from Outer Space
No. of persons attending_____

_____
Member's Name

_____
Street

_____
City State Zip

_____
Phone (daytime) (evening)

Amount enclosed: $_____

All reservations will be confirmed.

For further information call Dorothy Roder, Field Museum, 922-9410, ext 206 or 219.

MEMBERS' CHILDREN'S WORKSHOPS

The highly popular series of Saturday Workshops for children and grandchildren of Museum Members will again be offered during April by Field Museum's Department of Education. These workshops are designed to stimulate and develop interest in the natural sciences by providing the children with an opportunity to meet Museum staff members and work with materials and specimens from the scientific collections. Creativity is encouraged in the making of "take home" items. Workshop themes are geared to different age levels and interests.

Each workshop is presented just once and each lasts about one hour and fifteen minutes. The morning programs, for children ages 7-9, begin at 10:30 a.m.; the afternoon programs, for children ages 10-13, begin at 1:30 p.m. Attendance at each session is limited to 20, so that each youngster can have a close working relationship with the Museum instructor.

Children may register for one workshop only; this is to allow us to accommodate as many children as possible. To make your reservation, call 922-9410, Ext. 219 and ask for Miss Mary Lee. Reservations will be accepted until all openings are filled. Reservations will be confirmed by phone at the time they are made.

All participants are requested to meet at the North Door Information Booth at least fifteen minutes before the scheduled starting time to check in and meet the Museum instructor.

We hope to offer more workshops later in the year, and we welcome your suggestions as to themes and age levels you would like to see covered.

Choose Your Totem!

Draw the head of your favorite animal on a paper bag. Wear the bag as a mask as you tell the group why you chose this particular animal. The afternoon program will emphasize stylized animal designs.

April 5: 10:30 session for ages 7-9
1:30 session for ages 10-13
Leader: Harriet Smith

Let's Look at Insects

An introduction to the great variety of insects with a chance to look closely at some familiar ones and some strange ones, too. Design your own "insect" from Museum raw materials.
April 12: 10:30, ages 7-9
Leader: Betty Deis

Chinese paper cutout

Start an Insect Collection

A look at various insect groups, plus your own beetle to pin "museum style," identify, and take home with you.
April 12: 1:30, ages 10-13
Leader: Betty Deis

Aluminum Zoo

Create your own "zoo" of African animals in mini-plaques after the fashion of a West African artist.
April 19: 10:30, ages 7-9
Leader: Edith Fleming

Gem Stone and Wire Crafts

Learn to design and shape a wire figure suitable for a small polished gem. Identify your gem by comparing it with stones exhibited in the Gem Room.
April 26: 10:30, ages 7-9

Chinese Paper Cuttings and Rubbings

Learn the Chinese techniques of cutting paper designs free hand and using the designs to produce rubbings.
April 19: 1:30, ages 10-13
Leader: Edith Fleming

Paleo-Detective Art

Reconstruct the appearance and natural setting of prehistoric animals by close observation of fossil skeletons.
April 26: 1:30, ages 10-13

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MARCH and APRIL at Field Museum

SPECIAL PROGRAMS

Continuing:

Craft Demonstrations and Discussions

"African Patterns," 10:00 a.m. to 12:00 noon, Mondays, Wednesdays, and Fridays. Entrance to Hall 27.

"The Ways of Our Ancestors: Traditions of Native North America," 10:00 a.m. to 12:00 noon and 2:00 to 5:00 p.m. Fridays. Hall 4.

Weaving demonstration by members of the North Shore Weavers' Guild from 10:00 a.m. to 12:00 noon on Mondays, Wednesdays, and Fridays. Spinning also shown on the first and third Mondays of each month. South Lounge.

Saturday Discovery Programs

A series of tours, demonstrations, and participatory activities offered by Museum volunteers between 11:00 a.m. and 3:00 p.m. includes Ancient Egypt, Prehistoric Man, Reptiles, Jewelry in Other Cultures, and Northwest Coast Art. For information on time, place, and topic inquire at Museum entrances.

FILMS AND LECTURES

"Ascent of Man," free film series, presented at 2:00 p.m. Fridays and Sundays through April 20 in the Lecture Hall.

The one-hour films cover a time span of more than two million years in exploring scientific discoveries that have shaped human history.

Mar. 2: "The Starry Messenger"
Mar. 7 and 9: "The Majestic Clockwork"
Mar. 14 and 16: "The Drive for Power"
Mar. 21 and 23: "The Ladder of Creation"
Mar. 28 and 30: "World Within World"

Free Ayer Adult Illustrated Lecture Series, "Expeditions Unlimited 1975," presented by Field Museum curators at 7:30 p.m. Fridays and 2:30 p.m. Saturdays in Lecture Hall. Seating is limited to 225 persons. Museum cafeteria is open until 7:30 p.m. Fridays.

Mar. 1: "Natural History of Deep Sea Fishes," by Robert Johnson

Mar. 7 and 8: "The Tunguska Explosion: Meteorite, Comet, or Black Hole?," by Edward Olsen

Mar. 14 and 15: "Wet Snails in Dry Deserts," by Alan Solem

Mar. 21 and 22: "Veracruz, Mexico: Green Grow the Lilacs," by Lorin I. Nevling, Jr.

Mar. 28 and 29: "Frog Ecology in the Congo," by Robert F. Inger

CHILDREN'S PROGRAM

Begins March 1:

Spring Journey for Children, "People of the Salmon and Cedar," a free, self-guided tour, routes youngsters to Museum exhibits relating to the Northwest Coast tribes. All boys and girls who can read and write may participate in the program. Journey sheets in English and Spanish available at entrances. Through May 31.

MEETINGS

Mar. 7, 8:00 p.m., **Chicago Anthropological Society**
Mar. 9, 2:00 p.m., **Chicago Shell Club**
Mar. 11, 7:30 p.m., **Nature Camera Club of Chicago**
Mar. 11, 8:00 p.m., **Chicagoland Glider Council**
Mar. 12, 7:00 p.m., **Chicago Ornithological Society**
Mar. 13, 7:00 p.m., **Chicago Mountaineering Club**

COMING IN APRIL

"Ascent of Man," free film series, shown at 2:00 p.m. Fridays and Sundays in the Lecture Hall.

April 4 and 6: "Knowledge or Uncertainty"
April 11 and 13: "Generation upon Generation"
April 18 and 20: "The Long Childhood"

Free Ayer Adult Illustrated Lecture Series, "Expeditions Unlimited 1975," offered at 7:30 p.m. Fridays and 2:30 p.m. Saturdays in the Lecture Hall.

April 4 and 5: "Collecting Mosses in Southern Chile," by John Engel

April 11 and 12: "Ancient Ecuador: Culture, Clay, and Creativity," by Donald Collier

Begins April 5:

Field Museum's Ray A. Kroc Environmental Education Program series, "Man Uses the Land." (See p. 8)

Saturday, April 12

Programs by leading performing arts groups, including the Chicago Brass Quintet, Dance Medium, and the Indian Trio, 10:30 a.m. to 1:30 p.m., Stanley Field Hall. Sponsored by Young Audiences of Chicago.

Opens April 18

"Ancient Ecuador: Culture, Clay, and Creativity," an exhibition of pottery, jewelry, and tools dating from 3000-300 B.C. Hall 9.

April 19 to 27:

Spring Holiday Programs include:

Films at 11:00 a.m. and 1:00 p.m. daily, Hall 27 Studio.

"African Patterns," craft demonstration and discussion, 10:00 a.m. to 12:00 noon and 1:00 to 3:00 p.m., April 21, 23, and 25, entrance to Hall 27.

"The Ways of Our Ancestors: Traditions of Native North America," craft demonstration and discussion, 10:00 a.m. to 12:00 noon and 2:00 to 5:00 p.m., Monday, April 21, and Friday, April 25, Hall 4.

"Fingertrips," a guessing game exploring the sense of touch, 1:00 to 4:30 p.m., April 22, 23, and 24, South Lounge.

"Environmental Awareness," a film-discussion program on endangered species, 10:30 to 11:15 a.m., April 22 and 24, Lecture Hall.

Craft demonstrations and discussions

Saturday Discovery Programs

Weaving demonstrations

MUSEUM HOURS

Open 9:00 a.m. to 5:00 p.m. Saturday through Thursday and 9:00 a.m. to 9:00 p.m. Friday.

The Museum Library is open 9:00 a.m. to 4:00 p.m. Monday through Friday. Please obtain pass at reception desk, main floor north.

Museum telephone: 922-9410

April
1975
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Field Museum of Natural History Bulletin

Field Museum of Natural History Bulletin

April 1975
Vol. 46, No. 4

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Calendar of Coming Events

COVER

Pottery figurine of a Chorrera woman with geometric body painting. Ca. 800 B.C. One of 600 pots, figurines, tools, and other artifacts from ancient Ecuador, on exhibit in Field Museum's Hall 9, April 18 to August 5. See page 8.

Field Museum of Natural History
Founded 1893

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A Calorie-Counter's Guide to the Energy Crisis

by Edward Olsen

Calorie-counting has become a habit for many Americans who are concerned about spreading waistlines and clothing that used to fit, but just won't quite squeeze on anymore. Although we are accustomed to the notion of counting calories, few are aware that calorie-counting is going to concern all of us during the next decade, whether we are overweight or underweight. We are going to have to start considering the calories that enter into all aspects of our lives, other than simply the food calories we eat. A calorie is a measure of energy of any kind, and energy—or the lack of it—is going to affect our lives as it has not since the beginnings of this country.

The phrase "energy crisis" has been bandied about during the past two years in the press, by politicans, and by individuals in governmental as well as private sectors. Confusing, sometimes conflicting, claims are made for the seriousness of this crisis, or even of its existence at all. Although some Americans feel a gnawing distress over the nature of this issue, it is clear that most Americans do not take it seriously.

The standard sources of information for most Americans are newspapers, radio, and television; but by their very nature, these media cannot present much more than piecemeal aspects of this whole complicated issue. It is the purpose of this article, and other articles to appear in subsequent issues of the *Bulletin,* to present some details on this problem in more depth than the popular media are able to offer. Most of what will be said here has been gleaned from reports issued by governmental agencies, industry, and private research groups.

First, let's start with a few definitions. What is energy? We all know what is meant by an "energetic person," but getting it down to a quantitative matter is something else. In the simplest terms, *energy* and the notion of *work* are equivalent, because we measure energy by the amount of work required to create it, or to alter it. For example, if someone left a parked car on top of a slope and forgot to set the brakes, the car would start slowly rolling downhill. The rolling car possesses energy. One way to stop it, if it's not yet going too fast, is to get in front of it and push in the opposite direction, gradually slow it to a halt and hold it until someone can get in and set the brake. In stopping it this way, one applies a force over a distance. A force applied over a distance is exactly the physical definition of *work.*

As another example, imagine a man, without tools, on a tropical island, who wants to break open an especially hard coconut. He picks up a heavy boulder and drops it on the coconut, with no success. It occurs to him, that if he could drop the boulder from a greater height it would have enough energy to break open the coconut. He could climb a tree with the boulder tucked under his arm and drop it from there, but that would be stupid. Instead, he throws a long vine over a high branch, ties the boulder to one end and starts pulling on the loose end of the vine. By giving a series of short pulls, one after another, he gradually raises the boulder up many yards into the air. He has provided a force (lifting the boulder) over a distance of many yards by the series of shorter pulls all added together. Thus, he'd done more work than he did originally by simply raising the boulder a few feet by hand. He let's go the vine.

Edward Olsen is curator of mineralogy.

Numerical examples used in this article are derived primarily from studies made in 1973-74, and may not coincide with figures that have appeared since then in the media.

The work he put into the system is now translated into the energy of the fall of the boulder, which hits the coconut and breaks it open. More work meant more energy. It's interesting to note here, that in order for the man to do this at all, he had to have eaten enough food to give his body the energy to do the work. The food itself originally came from, say, the meat of some animal, which ate enough grass to get its energy to live and grow. The grass, in turn, received its energy from complicated processes of turning soil nutrients, air, and the sun's energy into leafy matter.

The point to be made here is that energy moves from place to place, from one form to another form, but is not destroyed, only changed in its manner of expression. It took men in the sciences many centuries to realize this, but the idea was actually formulated less than 150 years ago. It is called the *Law of Conservation of Energy*. Energy can change the forms in which it expresses itself, but it is never lost. This idea marked a major turning point in scientific thinking. In recent years, the outspoken environmentalist, Barry Commoner, popularized the idea with the phrase, "There is no free lunch." That is, you do not get something for nothing. You can't create work (energy) without expending it, because in the end it must all balance out. It is, what some sophisticates call, "a zero-sum game."

In defining a method for measuring energy, many terminologies have arisen over the past hundred years. Because the word *calorie* is familiar to most people we will use that word here. The calorie is the amount of energy (work) involved in raising the temperature of one thousand grams of water by one degree on the Centigrade temperature scale. This is also called the kilogram-calorie or the large calorie. To give you an idea of what this unit is worth in everyday terms, it takes about 590 such calories to completely boil away a quart of water. It is the calorie we are already used to when we speak of food calories. Thus, a cup of sugar has 770 calories, which is energy equivalent to boiling away about 1.3 quarts of water.

In discussions of energy in the United States you will often see reference to the BTU, the British Thermal Unit. This unit of energy is equal to approximately ¼ of a calorie, or saying it the other way around, one calorie is equal to about 4 BTU s. The BTU is a unit that will be eventually phased out as the United States goes on the metric system. As a matter of fact, it is no longer an official energy unit in Britain, where it originated.

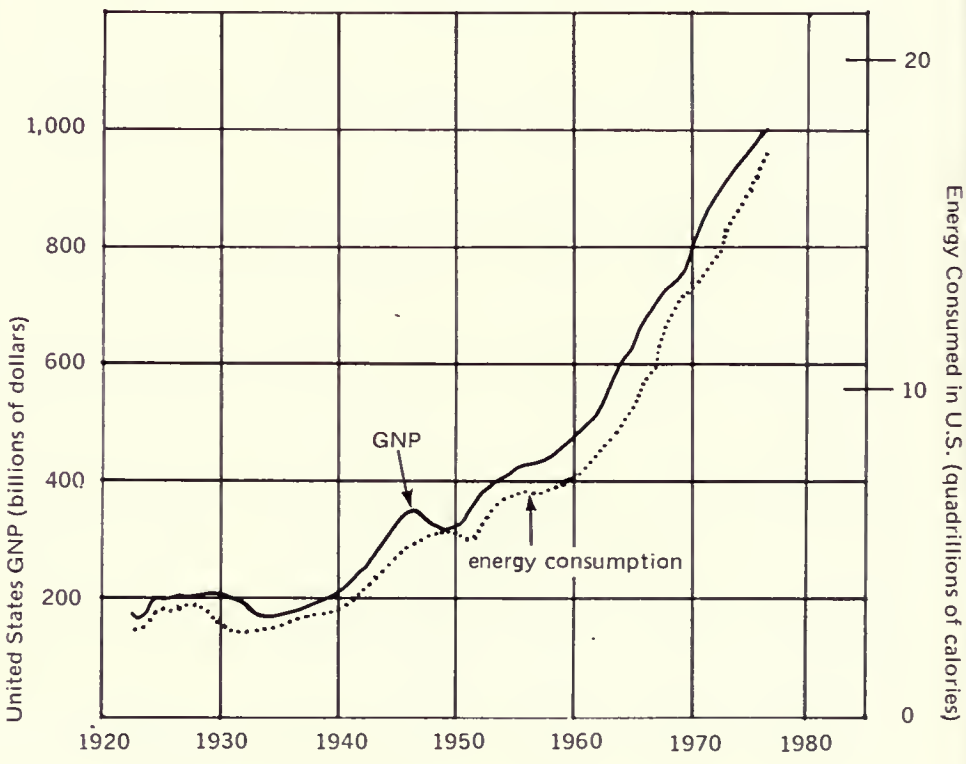
Having a feeling now for some of the concepts and terminology used in reference to energy and work, we can look at some of the problems that have arisen concerning the forms in which it occurs, and our patterns of use.

Patterns of Energy Use in America

Americans have been called "energy hogs." To a large extent, this is true. The energy we use comes from a long list of sources, of which only a few are major ones, namely, the fossil fuels: petroleum, natural gas, and coal. These together have provided 95% of our energy over the past several decades. During the past year we used 18,185,000,000,000,000 calories! Going back to our water-boiling example, this is enough energy to boil away about 9 trillion gallons of water. In terms of our population, it means about 82 million calories for every man, woman, and child in the country. This does not take account of the food calories eaten by our population, which add up to about 160 quadrillion calories, bringing our grant total of energy to 18,185,000,000,000,000 calories. Perhaps more important is the fact that we have been gobbling energy at an ever-greater rate, year by year. Annually, energy demands rise about 5% from the previous year, which means that the above number will be twice as large a mere fifteen years from now: 1990. The United States, with only 6% of the world's population, uses close to 30% of the world's present energy!

This statement is frequently made with a strong hint that this level of energy consumption is not only inequitable but downright immoral. On the other hand, we have seen in our definition of calorie, that energy and work are directly related to each other. Work makes foods, products, and services. There is a direct relationship between the gross national product, GNP, (the sum of all crops,

Figure 1



goods, and services) and energy consumption (*Fig. 1*). As the United States energy use has soared during the past decade from 10 quadrillion calories to 18 quadrillion calories, the GNP has gone from $581 billion to $821 billion (relative to 1958 dollars). Although it is clear that the people of the United States are the first recipients of a better standard of living from this expenditure of work (energy), it is also clear that exported food surpluses and goods for export have added to the material lot of numerous nations throughout the world. Thus, the "calories per person" figure for the United States alone does not give the whole story.

As a matter of fact, if one takes the GNP figures for all the nations of the world together, the United States GNP comprises approximately 30% of the total. Thus, using 30% of the world's energy (work), it produces foods, goods, and services in proportion to its energy use. The image of the great giant, lolling like a parasite, gulping the energy of the world to the detriment of all others, is far from accurate. It is, perhaps, the only bright spot in the entire situation. Now let's look at a breakdown of how we Americans use this energy.

In Table 1 we see a fairly even distribution of calories between the four main sectors of our country's economy in 1972 (the last year for which the most complete figures are available). Comparing these figures to a mere five years earlier, 1967, we see that industry (including agriculture) has actually declined in its percentage use of energy, while electrical use has increased relatively. More informative are the percentage increases shown in the right hand column. Both transportation and electrical use have made monstrous leaps compared to industrial, commercial, and household use.

Increased production of electricity, of course, is not an independent figure. Obviously, electrical energy is fed into households, commercial establishments, and industry. Such industries as steel have gradually gone to the use of electric hearths. Commercial establishments have increased lighting, often leaving giant shopping center parking lots fully lit all night long. Households have increased their uses of electrical appliances enormously, especially air-conditioning, which gobbles energy at a huge rate at quite low efficiency. We fill our lives with labor-saving devices and then count food calories to take off the weight which we have gained by too little physical activity—certainly a paradox. And, as we know too well by now, the increase in the transportation figure reflects mainly the use of private automobiles. Some of the transportation increase is due to industrial and commercial increases, of course. Private automobiles, however, account for nearly 40% of the transportation energy consumed in the country, and it has been said that over half of this is consumed within 20 miles of our homes: short runs to the store, to mail a letter, etc. Someone once quipped that the average American would drive to the bathroom if he could do so.

TABLE 1

CALORIE CONSUMPTION IN THE UNITED STATES

	1967		1972		
	Calories (in quadrillions)	Percent of total	Calories (in quadrillions)	Percent of total	Increase from 1967 to 1972
Household and Commercial Uses	3.8	25.9%	4.3	23.7%	13%
Transportation	3.1	21.3%	4.0	21.9%	29%
Industry	4.5	31.0%	5.2	28.7%	16%
Electrical	3.2	21.8%	4.6	25.7%	44%
Total	14.6		18.1		

Although there is, at present, no absolute shortage of energy in the world, there are political and economic factors that are acting to put stress on the consumption pattern by Americans, the largest single group of energy consumers in the world. We may resent this, but, as we shall see, it may be a blessing in disguise. It is not our purpose here to dwell too much on the economic and political factors, but to look mostly at physical energy resources and options in some detail. For each energy source there is a complex interaction of physical (often geological) factors, business factors, governmental policies, and environmental and social concerns.

Petroleum

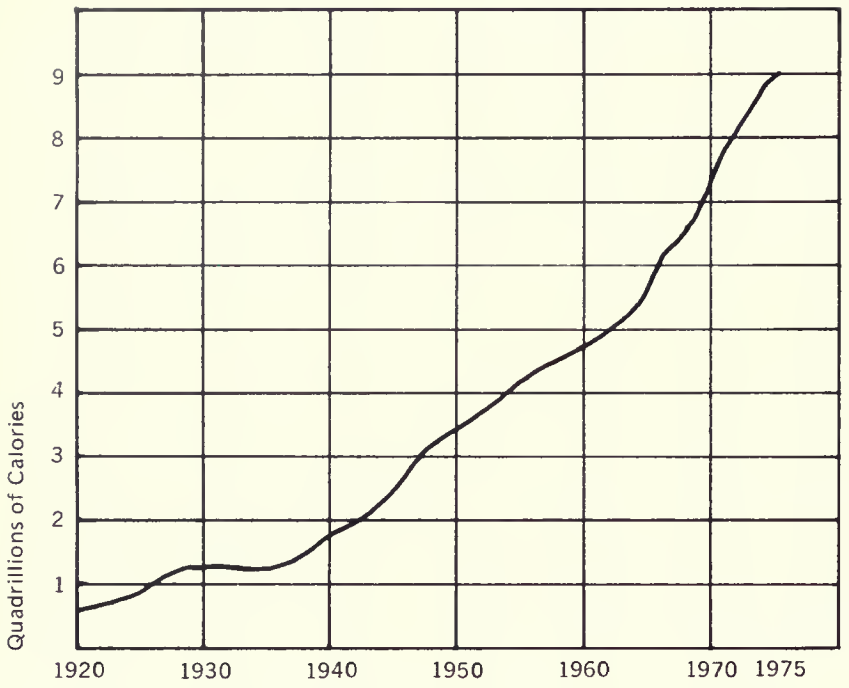
Oil is an extremely versatile resource. It can be used for fuel, to make an endless list of synthetic products — notably nylon, dacron, and all of the many plastics — and could ultimately be converted into edible foodstuffs. Petroleum production and consumption have been increasing annually for the past 30 years (*Fig. 2*). We currently obtain about 46% of our annual energy from petroleum, or about 8 quadrillion calories. This amounts to about 16 million barrels each day, of which we must import 6 million per day, the remainder being provided by domestic sources. Our concern here is with *domestic* petroleum resources only. The prognosis is not good.

Until 1948 the United States was an exporter of oil. After that we became an importer, to a gradually increasing extent. Until 1968 we could have gotten along without importing, because of some unused capacity, that is, proven oil wells not in production for one reason or another. Since 1967 our reserves have been declining steadily.

In the oil industry there are several keynote figures to watch, but the simplest one to understand is what is called the F/P ratio, the finding-to-production ratio. This means, for example, that if one finds, say, a 32 million-barrel oil field at the same time the industry is producing 16 million barrels,

Figure 2

Petroleum Consumption in the United States 1920-75

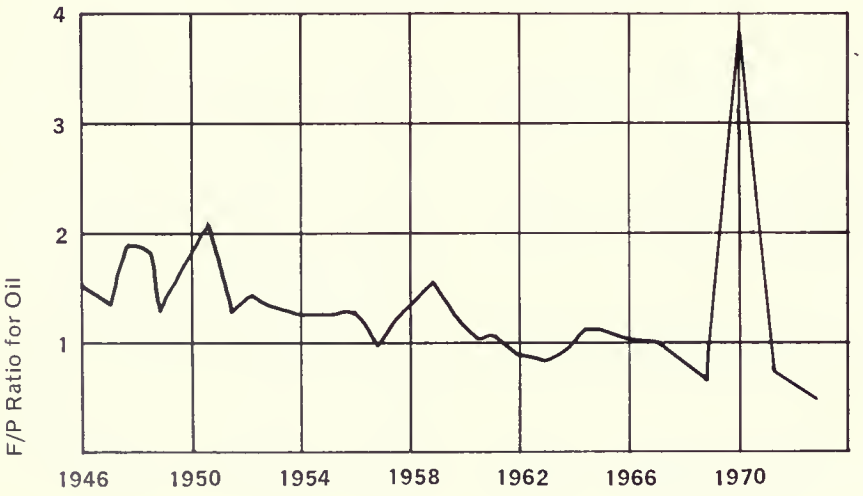


then the F/P ratio is 32/16 = 2, and all is rosy. When, however, the ratio reaches one it means you are only finding enough to just replace what is being consumed. When the number decreases to less than one, it means you are consuming more than is being found, and that you are on the road to running out. Fig. 3 is a charting of the F/P ratio for the United States from 1946 to the present. It is clearly a declining number, dropping below one for most of the years since 1961. The large jump for 1970 represents the oil finds at Prudhoe Bay, Alaska. Immediately after that, however, the ratio plunged to below one, where it is today.

Domestic oil production peaked in 1970 at 4.1 billion barrels, but despite a 6% increase in demand, each year's production since then has declined several percent. When the Alaskan fields actually come into production, smaller imports will be required for a time. But even these new fields are not infinite and it will take at least seven years to get them into full production.

Figure 3

(Source: R. L. Major, Illinois Geological Survey)



From time to time one hears consumer advocates make the statement that in any given oil field over half the oil that was there originally is still down there. This is true. Most fields yield between 35% to 40% of the oil in them. The implication by these individuals is that there is some sort of industrial skulduggery taking place to withhold part of the known oil reserves in order to drive up the price; but such is not the case. In order to understand this, it is necessary to look at just how oil is produced.

In the average field the oil consists of a mixture of many different chemical compounds, most of them known generally as the paraffins. These range from the light paraffins, such as methane, which is a gas, to intermediate paraffins, which are liquids, to the heavy paraffins, which are thick, gummy, and tarry. The oil is located in the small interstitial spaces between mineral grains, such as the grains of sand in sandstone. The oil is held under pressure due to the load of overlying and surrounding rock formations. The pressurized liquid protion is charged with bubbles of the gaseous compounds, much like a soft drink is charged with carbon dioxide gas bubbles. When a drill hole intersects the oil-bearing layers, there is a pressure release, as when opening a soft drink bottle, and the gaseous bubbles tend to move toward the opening. If a pump is put on the hole the bubbles move upward, pushing along the liquids with them, and you then have a production situation. Finally, a stage comes at which the gaseous compounds have been completely drawn off. This happens, on the average, when more than half of the liquid paraffins are still left, along with the tarry ones. Pumping "unbubbly" oils thousands of feet up to the surface simply can't be done. It's too heavy.

There are two things, however, that can be done. A second drill hole is put into the same layer at a moderate distance from the production well. Through the second well it is possible to

inject gases (even air) to push the liquids toward the production well, or, what is usually done, water is force-pumped down the second hole to push the oil toward the production well. Since oil and water do not mix, the water floats the oil ahead of it to where it can be pumped, because there is now a pressure from below pushing it. This process is called "water flooding," or *secondary recovery*. But even after secondary recovery, as much as 60% of the oil remains down there. It cannot be pushed or pumped, because its passage is blocked by the tarry paraffins that have been there all along, clogging at least 60% of the pore space. In virtually all domestic oil fields secondary recovery has been employed already and is figured into our knowledge of our reserves.

Beyond this stage, further recovery becomes difficult. It involves the use of highly complicated chemicals, called emulsifiers and surfactants. These are able to break up the tarry paraffins into tiny globules, which are then capable of moving through the small pore spaces; they can thus be pumped out under injected gas or water pressure. Most petroleum companies have devoted years of research to this process, called *tertiary recovery*. At present there is only a miniscule productive capability to produce the chemicals needed for tertiary recovery, and it is an expensive process. In test cases, however, yields of more than 95% of the total original oil have been recovered by this process. Even, however, were we to decide to embark on a major tertiary recovery program for all domestic oil fields, it would require at least a decade to build the productive capacity to make the necessary chemicals required to do the job. This doesn't help us in the short run. Since 1972 the ability to significantly increase annual output from proved reserves is virtually nonexistent, and any significant improvement before 1985 is an unrealistic hope.

Domestic Petroleum Reserves

In an article such as this, it is impossible to go into details of the question of what actually constitutes a *reserve* of petroleum, or any mineral resource, for that matter. Only a few words can be said about the concept.

Consider this: let's suppose we know that a certain oil field has 100 million barrels of oil in it. We know that with secondary recovery we can only hope to draw, say, 40% of this, or 40 million barrels. So *that* is our reserve for that field; a clear-cut case.

Take another case: suppose there is a 10,000-barrel oil occurrence at, say, 8,000 feet underground. For such a small field we must consider the price of the oil and what it costs to recover it. Also, we must consider how much energy it takes to recover this much energy. 10,000 barrels of oil contain 14 billion calories. With 40% recovery we can count on obtaining only 5.6 billion calories. We must then consider the number of calories (work) spent in drilling at least two 8,000-foot holes (for secondary recovery), the human work involved, pumping (oil up, water down), and transportation of this oil to a refinery. If that total expenditure of energy exceeds, or comes close to, the 5.6 billion calorie figure, then there will be *no time* when the extraction of this pocket of oil can ever be justified, unless we want the oil for some use other than as an energy resource, say, to manufacture plastics.

The question is, then, does one include that 10,000 barrels into a national estimate of domestic oil reserves? The answer is clearly, "No." If there were ten thousand separate such small occurrences, it would mean 100 million barrels that could not reasonably be counted into the reserve picture. Thus, the question of reserves, which has emerged in the press with often conflicting claims by different "authorities," is not a question that is easy to answer.

At the present time, estimates of domestic reserves are available from many sources, from which we will use three here: (1) the United States Geological Survey official estimate; (2) the estimates of the oil industry itself, exemplified in this article by the Mobil Oil Corp.; (3) the estimates of Dr. M.K. Hubbert, currently employed by the U.S. Geological Survey, but differing from the Survey's estimates. The results are shown in Table 2. It is clear from this table that even the experts disagree. It is, however, possible to select from among these figures. The method of reserve analysis by the U.S. Geological Survey is clearly the most optimistic. Although it is not possible here to show in detail how that agency arrived at its rosy figure, careful examination over the past few years has indicated the estimate is probably the least reliable of the three. (There are rumors this estimate may be soon revised downward.) Mobil Oil Corporation's estimate is a somewhat more complicated variant on the U.S. Geological Survey method of analysis. Hubbert's extremely logical estimate, on the other hand, is based on careful mathematical principles. I find this estimate the most convincing, and, as we shall see, it has demonstrated a high degree of success in its predictions.

(Continued on p. 20)

TABLE 2

MAXIMUM RECOVERABLE OIL* AND GAS RESERVES FOR THE FIFTY STATES (ESTIMATED)

Source of Estimate	Oil (in billions of barrels)	Natural Gas (in trillions of cubic feet)
U.S. Geological Survey	400	2,000
Mobil Oil Corp.	88	443
M. K. Hubbert	131	1,126

*Includes crude oil and natural gas liquids

ANCIENT ECUADOR: Culture, Clay, and Creativity, 3000-300 B.C.

On April 18, Field Museum will open a major special exhibition of 600 objects revealing the art and life of the first settled peoples on the coast of Ecuador.

by Donald Collier

The exhibition is exciting because it presents the earliest known ceramics (3100 B.C.) in the Western Hemisphere. These ancient pots are surprisingly sophisticated. This is the first such exhibition ever undertaken; in fact, most of the information and objects have been known for less than twenty years. This material has never before been presented to the public in Ecuador or elsewhere.

The exhibition is arresting also for its rich and varied art, mainly in the form of ceramic sculpture and effigy vessels depicting plants, animals, and men. The plants and animals are so carefully observed and realistically depicted that botanists and zoologists of Field Museum were able in most cases to determine the genus and often the species of the fruits, vegetables, mammals, birds, fish, and reptiles shown. In some cases the life habits of a creature are suggested, as in the case of the laughing falcon killing a gorgeously depicted fer-de-lance. Snakes are this falcon's principal prey.

This art is beguiling to children—the exhibition is a veritable ancient zoo—and aesthetically exciting to adults. The collection sheds a revealing light on the natural environment of coastal Ecuador during the period 5,000 to 3,000 years ago and on the relation of the ancient Ecuadorians to their surroundings. Information on food, housing, personal adornment, ideas about the supernatural, curing of disease, and the use of hallucinogenic drugs—all are revealed in this art.

The potters of the Chorrera period (1000-300 B.C.) were particularly attracted to the whistling vessel. This bottle has a tall tubular spout, loop handle, and one or two whistles that are sounded by an air stream activated when liquid is poured into or out of the bottle. The two whistles may occur in unison, pitched slightly apart to produce musical beats, or in thirds or fifths. Two of the three whistling bottles illustrated here are outstanding examples of the Chorrera potter's art. The first, a supremely elegant globular bottle with a tall spout, shows two characteristic Chorrera decorative techniques: negative or resist painting (multiple discs) and iridescent painting (pinkish iridescence in geometric bands). The other, depicting a seating man, is a true tour de force unequaled by any other piece of pottery from South America of whatever period. His ten clearly-shown deformities, injuries, and diseases surpass the physical afflications of Job. Of particular interest is the overall patterned use of rocker stamping to depict a skin disease. The superb technical and aesthetic excellence of this piece and the many symptoms shown suggest that it may have been commissioned about 600 B.C. by a shaman, the village healer, for use in curing rituals.

The exhibition demonstrates the significant fact that intensive farming, permanent villages, and developed ceramics were at least 1,000 years older in Ecuador than in Peru and Mexico. This stage of development is called the Formative by archaeologists. Scholars have generally believed the stage evolved first in Mexico and Peru and spread from there to Central American and northern South America. The new information from Ecuador calls for basic revisions of the accepted theories on the origins of New World Civilizations. We see an active trade moving outward from Ecuador between 1800 and 800 B.C., which stimulated the spread of Ecuadorian technology, art motifs, and ideas to Peru and the Pacific coasts of Guatemala and Mexico.

The origins of the Formative cultures of Ecuador are still partially obscure, but there is a very high probability that they were indigenous to northern South America. The exhibition presents the theory that the first intensive agriculture, large villages, and pottery in the New World developed in the tropical forest east of the Andes, perhaps as early as 5000 B.C., and spread over the mountains to the coast of Ecuador, where we find them well established before 3000 B.C. By then the coastal dwellers were growing corn, squash, gourds, and manioc and living in villages with 2,000 inhabitants.

Ninety percent of the material in the exhibition has been borrowed from private and museum collections in Ecuador. A printed catalogue with 600 illustrations and a text by Dr. Donald W. Lathrap of the University of Illinois, Urbana, will supplement the exhibition. The exhibit labels and most of the catalogue are in Spanish and English. After it closes at Field Museum on August 5, the exhibit will travel to New York, Minneapolis, Urbana, and Kansas City, and finally will be shown in the Ecuadorian cities of Quito and Guayaquil.

The exhibition and catalogue have been made possible by generous grants from the National Endowment for the Humanities, the Illinois Arts Council, and private donors.

Donald Collier is curator of South and Central American archaeology and ethnology.

Valdivia pottery jar with modeled corn ears and incised motif of corn leaves. Ca. 2000 B.C.

◄ *Chorrera jar depicting a cebus monkey scratching itself. Ca. 500 B.C.*

Large Chorrera jar with modeled crab on the top and a painted incised harpy eagle design on the shoulder. Ca. 800 B.C. ►

◄ *Chorrera whistling bottle showing a dog. Ca. 800 B.C.*

Whistling bottle depicting a man whose ten clearly-shown deformities and diseases surpass the physical afflictions of Job. This supreme example of the Chorrera potter's art may have been commissioned by a shaman for use in curing rituals. Ca. 600 B.C. ►

◄ *Pottery figurine of a Valdivia woman. Ca. 2300 B.C.*

Chorrera whistling bottle with negative painting and iridescent painting in broad bands. Ca. 600 B.C. ►

◄ *Valdivia jar with pie-crust rim; the oldest known pottery in the Western Hemisphere. Ca. 3100 B.C.*

Chorrera acrobat performing a back-bend. Ca. 900 B.C. ►

our environment

Illinois Bald Eagles on Increase

Bald eagles were not an uncommon sight in Illinois this winter, and eagle-watchers are sounding notes of optimism in the encouraging ratio of immatures to adults observed. The count by U.S. Fish and Wildlife personnel along the Mississippi from Dubuque, Iowa, to Rock Island, Ill., recently was 135 bald eagles, with a ratio of two adults to each immature bird. The same ratio was seen in the Mississippi River backwater areas from Bellevue, Iowa, five to six miles downstream, where 90 eagles were counted. In Crab Orchard National Wildlife Refuge, in southernmost Illinois, 23 bald eagles were reported in approximately the same ratio.

At Horseshoe Lake 48 were observed, including 18 immatures, and 15 were seen at Union County Conservation Area, with 8 immatures.

At Chautauqua National Wildlife Refuge, in west central Illinois, 34 bald eagles were seen—half of them adults, half immatures. The improved adult:immature ratio of late is attributed to the ban on DDT.

Illinois residents also saw more of the pileated woodpecker this past winter; 51 were seen in Union County during the Audubon Yule bird count and 15 were counted at Horseshoe Lake. Unusual sightings included the snowy owl in Brown County, rock wren (the third reported sighting in the state), black and white warbler (first ever seen in Illinois in winter), vesper and Lincoln's sparrows, pine warbler, and Virginia rail.

Peregrine Falcons Reintroduced

The endangered peregrine falcon, killed off in the wild by DDT east of the Rocky Mountains by the 1960s, will be returned to several Atlantic coast sites this spring by the U.S. Fish and Wildlife Service. A number of falcons bred in captivity at Cornell University by ornithologist Tom Cade will be released in a cooperative venture involving the U. S. Army Material Command, the National Audubon Society, the Peregrine Fund of Cornell University's Laboratory of Ornithology, the U. S. Forest Service, and the U. S. Fish and Wildlife Service.

The experimental reintroductions will first take place in New England, New York State, and in the Chesapeake Bay area. Subsequent releases each spring thereafter are planned for the East Coast now that Cornell University has developed a successful captive breeding program. In 1974, the university's ornithology lab produced 23 young peregrines, 29 prairie falcons, 7 lanners, and 2 gyrfalcons.

A western breeding facility for peregrine falcons has also been established under the direction of Cornell's raptor staff at a research site in Colorado in cooperation with the Colorado Divison of Wildlife. Young peregrines raised there are scheduled to be returned to western wild lands in the near future.

The upcoming trial releases on the East Coast will concentrate on an adaptation of the falconer's technique of "hacking." A week before nestlings reach the flying stage, groups of four to six will be placed in protective enclosures at suitable eyries—either natural cliff sites or on manmade structures. As soon as the birds are capable of sustained flight, they will be released from the enclosure and allowed to fly free. Having learned to associate the hacking station with food, they will return to it for their meals until they are able to sustain themselves by their own hunting efforts, normally three to four weeks after first flying.

Only after a large number of banded and color-marked falcons have been hacked in this way will it be known how successful they will be in surviving to breeding age and whether they will return and breed in the areas where they were originally hacked. The working hypothesis is that these young birds will develop a lasting fixation to the site, or at least to the immediate area where they are hacked, and that survivors will return to the same places to breed at the age of two or three years.

The peregrine falcon resembles a medium-sized hawk with long, pointed wings and long tail. It is known for quick, deep beats. The adult is slate blue-grey above and its wing, tail, and flanks are barred with black. It has a white throat with black streaks on each side of its face.

Currently the bird is wiped out east of the Rocky Mountains in the United States, in Ontario, southern Quebec, and the Maritimes. Local declines have also been reported from the western United States, the Yukon territory and interior Alaska. The bird's status in the eastern Canadian boreal forest is unclear but evidently it is not numerous there.

The number of *known* eyries with adults present is currently estimated at no more than 50 in the United States south of Canada. A few hundred pairs of the Arctic subspecies peregrine still breed in northern Alaska and the moist subarctic forests of Canada and Greenland principally along major rivers.

The primary reason for the peregrine's decline is DDT. Falcon eggshell thickness has been reduced 15 to 20 percent since 1947. All field and laboratory evidence points conclusively to the cumulative effects of chlorinated pesticides and their breakdown products obtained by the falcons from their prey. The major culprit has been DDT and its derivative DDE, which have increased adult mortality, affected the peregrine's reproductive mechanisms, and caused eggs to become thin-shelled or otherwise nonviable. Habitat destruction and other human disturbances have also been factors in the bird's decline. DDT levels in the East have been declining, thus offering hope that the transplants will work permanently.

Audubon's Declining Bird List Grows Longer

The National Audubon Society's "blue list," its "early warning" indicator of bird species apparently headed for trouble, is growing longer. Newcomers to the list this year include the canvasback duck, a prized game bird on which the hunting season is now completely closed, and the purple martin, an insect-eater which can sometimes be persuaded to move into multi-unit bird houses. In all there are 51 species on the 1975 blue list, five more than last year. Nine new species were added, but four others were dropped.

The blue list, published in Audubon's ornithological journal, *American Birds,* is intended "to give early warning of potentially dangerous, apparently noncyclical population declines," and does not include the 49 U.S. birds already on the endangered species list maintained by the Department of Interior. By the time a bird reaches "endangered status it may be so closed to extinction it may be difficult or even impossible to save it. The idea of the early warning list is to help spot trouble earlier so there will be a better chance of doing something about it.

Besides the canvasback and purple martin, the additions to this year's blue list are: reddish egret, mountain quail, upland plover, common nighthawk, Lewis' woodpecker, hairy woodpecker, and lesser goldfinch. Included in 1974 but deleted this year were the limpkin, Franklin's gull, gray vireo, and common yellowthroat. *American Birds* noted, however, that "de-listing in these instances is more a case of increased information or corrected misinformation than any real population increases in the species."

"One of the important functions of the list," observes the journal, "is to alert observers everywhere to pay special attention to these species and report all observations (or lack or them), so that more accurate evaluations may be made."

About the canvasback, *American Birds* says: "Although far from being a rare bird, this species has suffered serious decline in recent years and should be watched carefully." As to the purple martin, it is noted that declines have been "especially marked" in the Pacific Northwest, the Appalachians, the Middle Pacific, and Southern Pacific regions.

Blue-listing a species does not necessarily mean it is declining throughout its range; trouble in part of its range may indicate more widespread trouble is on the way. The hairy woodpecker was included on the basis of three reporters in Florida and the Central Southern Region. The nighthawk was added on adverse reports from the Hudson-St. Lawrence and two areas in the Middle Atlantic region.

Largest category on the list is the birds of prey, of which 14 species are included: the sharp-shinned, Cooper's, red-shouldered, Swainson's, ferruginous, Harris', and marsh hawks; osprey, caracara, prairie falcon, merlin, kestrel, and the barn and burrowing owls.

Pacific Walrus Hunting to Resume?

A proposal to waive the moratorium and implement regulations on the taking of Pacific walrus in the State of Alaska has been published in the *Federal Register* by the U.S. Fish and Wildlife Service. Under the provisions of the proposed waiver and regulations, management of walrus would be returned to the State of Alaska.

The principal effect of the proposal would be to allow once more the regulated sport hunting of walrus by all citizens, not just Alaska natives. This activity is expected to add fewer than 50 animals a year to the current average annual harvest of about 1,650 walrus, all now taken by Alaska natives for subsistence and their cottage industries. No return to commercial hunting will be allowed.

The primary biological factor behind the proposal is the fact that the Pacific walrus population in and near Alaska is approaching its optimum sustainable level, to maintain a balance with its environment.

Before large-scale exploitation by whalers of European descent which began in about 1868, the Pacific walrus was estimated to number about 200,000 animals. The population may have fallen to a low of 40,000 to 50,000 in the 1950 to 1956 period according to the best data available. Beginning in 1960, aerial surveys of walruses were taken and the total population was estimated to range from 73,000 to 117,000 that year. The 1972 surveys provided a median estimate of 135,000 walruses, and a range of 93,000 to 178,000. More recent studies indicate that the population is still increasing and is approaching its optimum sustainable level.

Federal Study of Endangered Butterflies

Forty-one species of possibly endangered or threatened butterflies are to be the subject of intensive studies by the federal government, twenty-six states, Cuba, Canada, and Mexico. Most of the butterflies under consideration in the study owe their reduced populations to two related problems—dependence on one primary food and land development. One of these insects is the Apache silverspot, a strikingly beautiful butterfly with a cinnamon brown top and silver spots underneath; it occurs in the Owens Valley and Mono Lake areas of California. It thrives on a type of violet which requires moist growing conditions. As the demand for water by nearby Los Angeles grows, drainage of water from Owens Valley will probably dry up the marsh areas where the delicate violet grows, thereby reducing the Apache silverspot population.

A Florida butterfly, the atala, which sports a velvety black and iridescent blue upper portion and orange and gold markings underneath, occurs only in the united States, even though it is a member of a group of tropical butterflies. In its caterpillar stage, the atala depends on the coontie, a primitive plant related to the sego palm. Current land development in Florida has destroyed several areas where coontie was available and now the atala appears only sporadically and unpredictably.

It is believed that butterfly collectors have not contributed to declining populations because collection usually takes place at a time of year after most females have laid their eggs and because males are most frequently the gender caught. Interestingly, the male butterfly is more frequently caught by amateur collectors because of its flamboyant tendency to flit about open meadows and marshes "looking for the action" while the female of the species maintains a somewhat more sedate posture nearer the ground.

This is the first attempt by the federal government to study butterflies that appear to be threatened or endangered. Several states have developed their own endangered species lists—some of which include butterflies—but the newly proposed study may result in the first national list of threatened and endangered butterflies.

Airline Fined for Animal Deaths

A major international airline has been fined more than $2,000 for inhumane transportation of wildlife, which resulted in the deaths of 151 animals in shipments totalling 168. Seizures were made at chicago's O'Hare International Airport by federal agents under the authority of the Lacey Act, which provides for penalties for the importation of birds and animals into the United states under inhumane or unhealthful conditions. Chicago is one of the country's nine designated ports of entry.

The first offense involved 79 tree shrews, of which 67 died from lack of water. For inhumane treatment, the airline was fined $920. In the second offense, lack of heat in a cargo plane caused 14 bushbabies (lemurs), 40 land crabs, and 30 skinks (lizards) to freeze to death. A fine of $1,090 was assessed for inadequate shipping conditions.

World Honeybee Population Drops

The world's honeybee population is dropping, and this could have an effect on man's food supply, says John Harbo, a U. S. Department of Agriculture entomologist.

"Man is at a point right now that anything that gets in his way ought to be sprayed and killed," said Harbo, research leader of the department's bee-breeding and stock center laboratory at Baton Rouge, La.

Harbo says that the bee shortage is not yet critical, even though the bees have been sorely affected by insecticides and herbicides and by physical intrusions into their habitat.

"This isn't something sudden. It's been happening for years," observed Harbo. "We're not going to run out of bees."

Some scientists are concerned about the effect that a drop in the world's bee population could have on food production. The successful growth of many fruits and other crops depends on cross-pollination by bees as they go from one flower to another.

One index of the reduction in bee numbers may be the recent, sharp increase in the price of bees. A queen bee today brings about $5.50—about double the price of a few years ago.

Farmers with crops that need pollination often employ a beekeeper who brings in his own bees. The number of such tended colonies, according to one report, has recently dropped more than 10 percent. The same report estimates that a worldwide decrease of almost 200 million has occurred.

A Lost Kingdom Mislaid

a short report on the search for Srivijaya

by Bennet Bronson

The dawn of civilization came late to Southeast Asia but when it did it came with special splendor: great temples rising from rain forests and rice-filled plains; sculpture equal to the world's best for delicacy and power; harsh monarchs ordaining majestic monuments and cities; traders pouring in from Arabia, Persia, India, China, lured by an awesome wealth of spices, dyes, incenses, gold.

Formerly, at about the time of Christ, there had been nothing here. The plains and islands of Southeast Asia held no more than a scattering of villages whose people were scientifically advanced for their day but, as far as we know now, no more given to creating states and founding cities than were the ancient Patagonians or Englishmen. Yet a few short centuries later all was changed. By A.D. 200 the first proto-states of Southeast Asia had come into being, by 700 most of the flatter and more fertile parts of the region had filled up with

◄*Head of the Sarangwaty Bodhisattva. Found during the excavation of a pond during the early 1960s, it dates to the 7th or 8th centuries A.D. This is the first published photograph.*

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political units of unquestionable civilizedness. The ruins these left behind are famous, impressive even when compared with those of Egypt or Greece. Their names, some still uncertain, roll smoothly off the tongue—Champa, Chenla, Dvaravati, Sailendra, Srivijaya, Pyu, Angkor.

Why this sudden flowering? What sustained these crocus-states after their first bloom? How did they work, worship, philosophize, survive? And why did they eventually, one by one and with none of the drama that hints at a region-wide catastrophe, decline and disappear? We cannot yet guess at the answers to such questions. While archeologists elsewhere may have been digging for upwards of a century, we in Southeast Asia have hardly begun. We have not even managed yet to frame the questions properly. Yet it is a question of this kind, a big one involving the origins and nature of a specific ancient state, that I wish to discuss here. The state was called Srivijaya. Its location and its very existence have caused much controversy.

Srivijaya is a famous place in the history books: A number of stone inscriptions mention it, as do many Chinese and Arab chroniclers of the period A.D. 700-1400. These imply that Srivijaya was a great power in its day, a center of wealth and learning whose navies swept the Southeast Asian seas for more than a half-millenium. But for all this literary prominence, the physical remains of Srivijaya turn out to be remarkably hard to find. Another unsuccessful attempt to discover these remains has just been made by a joint Indonesian-American team sponsored by the Indonesian Archeological Institute, the University of Pennsylvania Museum, and Field Museum. The attempt was well-planned and carefully executed, yet no sign of Srivijaya was found. Does this mean that the team looked in the wrong place? That we looked for the wrong thing? Or that Srivijaya did not exist, being just a figment of the imagination of ancient Chinese writers and modern Western historians? Before attempting an answer, let us go over the evidence and the attempt in greater detail.

Srivijaya is supposed by most experts to have been located somewhere on the swampy east coast of Sumatra, the large island at the western end of the modern nation of Indonesia. One of the main reasons for picking Sumatra is the island's strategic location. It lies on and along any possible sea route between China and the other great nations of antiquity in India, the Middle East, and the Mediterranean. Chinese sources record that this route was in use by A.D. 100, when Roman merchants began to arrive at the ports of the South China coast. Sumatra also lies across another major trade route, that connecting the Asian mainland with the Moluccas—the Spice Islands of legend—at the far eastern end of Indonesia. Since spices grown only in the Moluccas—cloves, nutmeg, and mace—were known to the ancient Romans, Indians, and Chinese, we may be certain that this route as well was used at an early period. There is even some evidence that Sumatra, besides being at a major crossroad for foreign trade, had itself a number of commodities to offer to world commerce: industrial resins, incenses, perhaps pepper, exotic materials such as horn of the rhinoceros and hornbill, and moderate amounts of gold.

It therefore makes sense that a trade- (and piracy-) oriented nation such as Srivijaya is said to have been would have grown up on the Sumatran coast. Another reason why this makes sense is that the whole vicinity is otherwise in a political vacuum. While important ancient civilizations are known to have begun to appear on the Southeast Asian mainland (in Vietnam and Thailand) as early as A.D. 100 or 200 and further out in the islands (in Java) by A.D. 600-700, the area in between has produced very little evidence of organized political centers earlier than A.D. 1400. Knowing that politics abhors a vacuum at least as much as nature does, are we then to assume that this central, strategic location remained out of the control of any state for 800 years after states appeared in the region surrounding it? Even if there were no direct evidence we would have to assume the existence of a Srivijaya.

Some direct evidence does exist, however. Chinese writers between A.D. 700 and 1400 persistently mention a place named Shih-li-fo-shih, or San-fo-ch'i, which seems to have been a naval power of some importance and which sent occasional tribute missions to the Chinese Emperor. Early Arab writers describe a fabulous land called Zabag or Sribuze. And no fewer than six inscriptions, all dating from the early 11th century, have been found in South India which mention a king of Srivijaya. None of these sources is very definite about Srivijaya's location. But it seems clear that it was on an island, close to the sea, somewhere on the route between China and India.

Why then should Srivijaya be sought on Sumatra rather than, say, on the Malay Peninsula or Borneo? Partly because—the traditional thinking runs—Sumatra is in the strategic position discussed earlier. However, there is another traditional argument as well, and this one has seemed nearly decisive to several generations of historians. Sumatra has produced almost all the known inscriptions, stone slabs with writing in a South Indian alphabet, that are earlier than A.D. 1000 and that mention the word "Srivijaya." Aside from one example found at Ligor in southern Thailand, all the rest (there are a total of six, plus fragments of two others) come from southern Sumatra and the nearby island of Bangka. Three of these were discovered in outlying areas, while the other three complete inscriptions and two fragments all turned up in the immediate neighborhood of the city of Palembang. These all mention the name of Srivijaya, were erected by that nation's king, and contain actual dates ranging between A.D. 682 and 686. Since the same vicinity has produced almost all the pre-1000 statues and other artwork known from Sumatra or Malaya, it has seemed certain to nearly everyone that modern Palembang and ancient Srivijaya are one and the same.

This at any rate was one of the notions we set out to check when we first began work in Sumatra, through extensive exploration in the summer of 1973 and excavations at Palembang in 1974. During earlier visits to Palembang we had become convinced that it contained an ancient city of some kind, since the empty ground just east of the modern city was littered with potsherds and other early debris. We were naturally quite aware that this ancient city might not be the Srivijaya of the chroniclers and historians. Looking for things with proper names is in fact generally a mistake in archeology, as is shown by innumerable disastrous attempts to find Solomon's

Temple, Noah's Ark, and Benjamin Franklin's false teeth. For every Schliemann who succeeds in locating his Troy there have been countless persons who have wasted time and money (and done irreparable damage to sites) because they focused on a problem too narrow and particularistic, not to say trivial. But on the other hand we did not greatly care whether the Palembang site turned out to be Srivijaya itself. What interested us was the general problem of the early history of urbanization in a part of the world where no previous research had been done. Since the Palembang sites appeared to be (1) a city and (2) at least as early as the 7th century inscriptions—which is very early indeed for a locatable city in island Southeast Asia—we felt that anything we found would be satisfactory. If by an improbable stroke of luck we could show one of the sites to be Srivijaya, that would be so much icing on the cake.

So in July of 1974 we began digging. Our basic work force consisted of fifteen local laborers and nine staff members, of whom three were foreigners and six were Indonesian archeologists from a university, a museum, and the national archeological institute. Having such a relatively large staff made it possible for us to continue with exploring while we excavated and, indeed, for some of us to go off later and do an entirely separate excavation in a prehistoric cave several hundred miles away. The initial exploring yielded dividends, however. As they walked over most of the empty fields in and around Palembang, the exploring teams made a series of good maps and located several new sites, at several of which we later excavated.

By September, when we stopped excavating, we had dug at four different locations around the modern city, which we called Geding Suro, Air Bersih, Sarang Waty, and Bukit Seguntang. All of these looked like good places to dig, because early statues or inscriptions had been

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Top: *view of Palembang near the Musi River. Park of the city is still built on pilings over the water.*

Bottom: *Beginning a testpit at Geding Suro, Palembang. Two of the small boys later became unofficial project employees.*

found there in the past and because the ground there was littered with the debris of former inhabitation, mostly potsherds and brick fragments, showing that those locations had once held not only shrines but also homes. The excavations produced still more residential debris: sherds, bricks, animal bones, bits of roofing tile, and a small number of corroded pieces of bronze and iron tools. They produced little except one or two fragments of decorated baked clay (originally architectural ornaments) and a cache of tiny tablets of unbaked clay—very soft and difficult to excavate—impressed with miniature inscriptions of Buddhist prayers. We found no stone-cut inscriptions and no statues, but then we did not expect to—archeologists make such major finds as these very rarely, and then only after digging on a scale much larger than we wished or could afford.

The usual way that an archeologist finds major works of art is for someone to show them to him. We did locate one in this way, a statue which had been dug up ten years before and kept in the finder's living-room. As those familiar with Asian art history will know, it is a figure of a Bodhisattva, an incarnated Buddha, executed in a style usually seen on representations of the Hindu god Vishnu and dated to somewhere between A.D. 600 and 800. Statues of this age and quality are quite uncommon in Southeast Asia. Hence, the Bodhisattva is a discovery of some importance, though not, strictly speaking, discovered by us.

However, the importance of the Bodhisattva pales beside another discovery. Not one of the smaller artifacts we found, including several tens of thousands of potsherds, were much older than A.D. 1300. How do we known this? Because all the sites we excavated produced large numbers of stoneware and porcelain sherds imported from China, Thailand, and Vietnam. And such "export ceramics," unlike most of the other artifacts one tends to find in Sumatra, can be accurately dated through comparisons with museum collections. We found more than 3,000 fragments of imported wares, and not one of these turned out to be older than the Yuan Dynasty in China (1279-1368), even though ceramics of Sung (960-1279) and T'ang (618-907) date are often found at other Indonesian sites. Further, in many of our trenches, the deepest (and thus oldest) deposits proved to contain ceramics of the 14th or 15th centuries.

The presence of so much imported stoneware and porcelain also made it possible to gain a rough idea of the dates for locally-made earthenware sherds. Because the imports appeared in the same soil layers as the local pottery, we could draw up tables showing that no kind of local sherd was regularly found in deeper layers than at least some kinds of imported sherds, and it followed from this that no local pottery was much older than the earliest imports. We sorted carefully through finds from 26 separate trenches in four locations as well as through finds collected from the surface at twenty locations more. But in none did we find a single sherd which we could not recognize as being closely similar to sherds found in association with post-Yuan imported ceramics. We concluded from this that the Palembang area contains few if any sherds, whether porcelain or earthenware, which were made before A.D. 1300.

Why is this an important discovery? Because Palembang has been supposed by almost everyone to be 700 years older than this. Setting aside the question of whether it really is Srivijaya, Palembang has in any case produced numerous objects dating to the period 700-1000, including four major and thirty minor inscriptions and nearly twenty statues. How can these objects be so early and the potsherds so late? Did we manage to miss the earlier pottery completely? Or did the early Palembangers for some reason not use pots?

The second of these alternatives is possible but seems a bit unlikely. It would make early Palembang almost unique among complex, "civilized" human societies, all of which since about 4000 B.C. (with the possible exception of the Dark-Age Irish) appear to have been interested in containers of fired clay. While it is true that pottery-using is not important in the mountainous areas of present-day Sumatra, one finds it hard to believe that the makers of the Palembang statues and inscriptions had no interest in either local earthenware pots or the highly prestigious porcelains which the Southeast Asians had been importing from China for all those years.

The first alternative, that we simply missed the earlier potsherds, seems to us equally unlikely. We walked over a large part of the Palembang area, including every place where early statues or inscriptions are known to have been found. We dug at the three of those places which produced the bulk of the statues and inscriptions. And much of the area in question is well above the flood-level of the local rivers, making it impossible for all the sherds to have been deeply buried or washed away. If those pre-1000 sherds exist they should be easy to find. Considering that even a modest town that lasts for a century can be expected to generate many thousands of tons of broken pottery and other non-biodegradable debris, the refuse of an imperial capital lasting (like Srivijaya) for five hundred years should stand out very obviously indeed—it should pave the earth's surface for several miles around. Yet we found nothing really old except inscriptions and statues. Although we managed to locate one city, one town, one monastic community and several dispersed villages, none of these settlements can be older than the 14th century. None was inhabited by the people who made the statues and wrote the inscriptions.

So we are forced to look for a third possible explanation for this situation of early statues and late pots. The only one that occurs to us is redeposition, that the statues and inscriptions were originally set up somewhere else and then, much later, moved to Palembang. It is a complicated explanation, and the good scientist prefers his explanations to be as simple as possible. But it has a good deal of plausibility. We know that at least some of the statues-and-inscriptions were not in their original positions when discovered in the 1890s and 1920s—one 8th century statue was discovered lying on a 16th century surface, and a whole group of 7th century inscriptions appears to have been found buried next to the grave of a 17th century king. That all of these objects were moved several centuries ago cannot be proved. However, it fits well with what we know about the attitudes of more recent Southeast Asians toward early monuments. The Thais, Cambodians, and Javanese tend to regard such objects as sacred or imbued with mystical (or magical) power; they often collect them, care for them, and take them along if their towns or villages have to be moved. Numerous Indian

inscriptions are known to have been transported from one place to another during the pre-European period; in Thailand and Laos famous statues have even had wars fought over them. Why the inhabitants of Palembang during the 14th-17th centuries should have wanted to collect monuments is not yet clear, nor is the place the monuments originally came from. But as of now it seems they did collect them. We may have stumbled into that old joke of archeologists, excavating in a museum.

What all this means in terms of the Srivijaya problem is also unclear. Beyond doubt, we feel, Srivijaya was somewhere else. We even think it unlikely that Srivijaya was anywhere nearby—certainly not at any spot along the banks of the Musi, the main river that flows through Palembang and gives it access to the sea. But this leaves unexplored a tremendous area of the Sumatran coast, much of it covered by almost impassible mangrove swamp. Perhaps it might be felt that mangrove swamp is not such a suitable place for an ancient city; on the other hand, we should not be too narrowminded in our notions of what such a city could be like. Sizeable kingdoms, like Bonny, Brass, and Calabar, existed in the swamps of the Niger Delta in West Africa during slaving days, and early travellers in Southeast Asia reported several cities (for instance, Brunei and Banjermasin in Borneo, Bangkok in Thailand, and Palembang itself) which were built wholly or partly on ratts and piles over the water. There is not even any real reason why a "city," understood as a major administrative and economic center of a political unit, should be fixed permanently in one place. One can imagine that the capital of Srivijaya might have been figuratively and literally a floating city, moved from place to place among the islands of the Southeast Asian archipelago in response to economic opportunities, dynastic intrigues, military problems, and administrators' whims.

As for the larger question, the origins and nature of early Southeast Asian cities in general, the Palembang excavations leave us no further forward than we were before. We may in fact have gone back a step, since now we know that no urban-sized site yet discovered in Sumatra goes back beyond A.D. 1000. The same is true for the southern Malay Peninsula, Borneo, the Philippines, Eastern Indonesia, and indeed for Java, despite that island's richness in early temples and other monuments. What it all comes down to is that we have not located a single city earlier than A.D. 1000 anywhere in Southeast Asia south of the Thai-Malaysian border, and this makes any discussion of urban origins rather uncomfortably abstract. While the cities are undoubtedly there, we have still to find them. Historical records, aerial photography and perhaps even electronic gadgetry may be useful. One suspects, however, that most of the cities will be found using that most important of archeological equipment, archeologists' eyes and feet. □

CALORIE-COUNTER'S GUIDE
(Cont'd from p. 7)

Perhaps more important than the estimates in terms of billions of barrels, is what each estimate means in terms of how long *domestic* supplies will last — taking into consideration current American use patterns. Petroleum consumption has been increasing at about 6% per year, as opposed to overall energy consumption, which, as mentioned earlier, is increasing at an average of 5% per year. If we assume a 6% annual increase, and start our computation at our present consumption level of 16 million barrels per day, then the U.S. Geological Survey estimate gives us 27 years of supply (to the year 2002; the Hubbert estimate is 14 years (year 1989), and the Mobil estimate gives us only 11 years (year 1986). In terms of the people, it means—taking the most optimistic view—that our children will be left to face a difficult time in their adult years due to our present use pattern, if it continues as it has.

Although many of us would like to think that by some stroke of luck huge new domestic reserves will be found, these hard figures tell us that this is not at all likely. If we wish to merrily roll along with our current use patterns, either our children will pay for it with lowered standards of living, or we must make up the difference by importing foreign oil. Economic considerations, mainly balance of payments, make this course impossible for very much longer, for by the year 1980 we will have to be importing 14 million barrels each day. At current prices this would be over $50 billion per year. Aside from economic factors, such extreme dependence on foreign sources makes the United States vulnerable both politically and militarily. So as far as petroleum is concerned, "Project Independence by 1980" is a hollow political slogan.

In addition, some of the possible exporting countries, such as Canada, Venezuela, and the USSR, can easily profit from a view of our history; by reducing or eliminating their exports, they can achieve their own petroleum independence.

The Question of Blame

Whenever some unpleasant situation arises there is always the question of whom to blame. In the case of petroleum, blame has been variously put on the government, the oil industry, and the consuming public. The truth of the matter is, all three of these are to blame and, at the same time, none is to blame. It is a complex of tax and legal policies, economics, judgments, misjudgments, and certain innate features of human nature. Although it is not possible to go into these aspects here, the upshot has been that for three decades or more, petroleum energy has been cheap, relative to the buying power of the average American. Thus, its use was both tacitly encouraged and overtly pushed. The efficiencies of petroleum-consuming equipment was not a major consideration. For two decades the overall miles-per-gallon performance of American vehicles has dropped steadily. At the present time it now takes 2,000 calories to move one person one mile by auto. By contrast, the figure for a bicycle is only 50 calories. Heavy industry, on the other hand, has generally attempted to keep efficiencies as high as possible, although even there it has been often more economical to continue use of lower efficiency machinery rather than undergo the higher cost of purchase and installation of newer, more efficient equipment that might become available. In general, at least 50% of the calories used are lost due to inefficiencies of various kinds, some unavoidable.

During the past decade, we have finally come to realize the degradation we have been imposing on our physical environment. The increased use of electricity has meant increased burning of fossil fuels in electrical generating plants. Until the mid-1960s most such plants burned coal. The inherent sulfur content of most coal created a major health hazard by adding noxious sulfur dioxide to the air. As a result, many of the generating plants went to the burning of oil or natural gas. In this regard, in the petroleum industry crude oil is referred to as "sweet crude," meaning low in sulfur, and "sour crude" (high sulfur). The high demand for sweet crude has decreased its supply faster relative to the total supply. But oil is such a versatile substance, it is a shame to use it for burning, and other methods of clean electrical generation are clearly required. These will be discussed in a future article.

Natural Gas

Since natural gas (mainly made up of the light paraffin, methane) is most often tied to the exploration and production of oil, the same factors that affect domestic petroleum apply here also. One additional aspect, however, has played a major role in the now serious shortage of gas. Since the mid-1950s, governmental regulations have fixed the price on interstate sales of natural gas at the production sites. The result has been severalfold:

(1) There is no incentive to put major expenditures into the exploration for gas *per se*. (2) When an expensive oil exploration program turns out to yield a field that has too little oil to pay for the cost of exploration, but does have abundant natural gas, the fixed price forces the producer to seek a market for as much of the gas as he can sell. Since he is fixed in the unit price he can charge, he tries to sell as large a volume as he can to pay off his exploration and development costs. One solution to this problem is to convince various industries to convert to gas for all their energy needs, and provide lower rates to big users. (3) The fixed price policy has discouraged the collection of natural gas from smaller fields or inconveniently located larger fields that are producing oil. In these cases the gas is "flared off," that is, burned in the field. In some fields such fires have burned for years to get rid of an unprofitable product. As one petroleum geologist put it, gas is like the sawdust that is a natural result of running a lumber mill. If one can sell the sawdust conveniently (at a fixed price) then that is done. If there is any problem with selling it, there is little incentive to overcome the problem.

Figure 4

(Source: R. L. Major, Illinois Geological Survey)

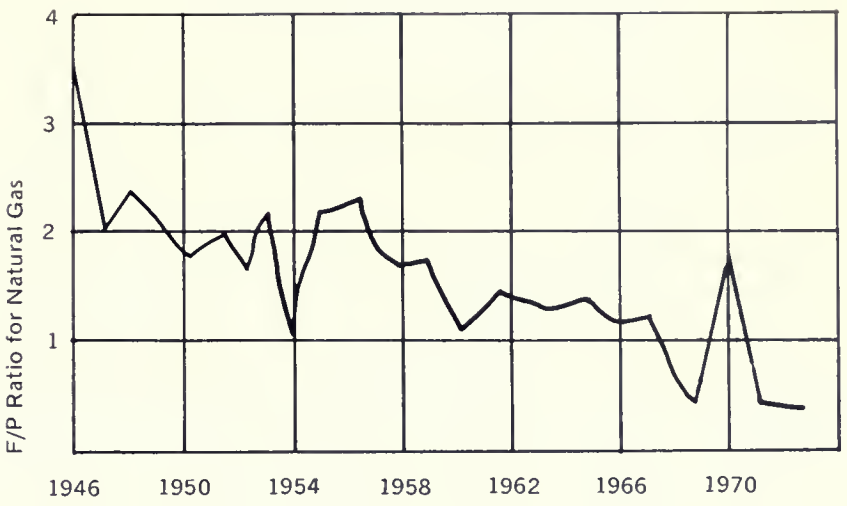

Fig. 4 shows a charting of the F/P ratio for natural gas. Comparison with Fig. 3 shows it is similar in trend to the ratio for oil. Since 1967 it has fallen below one, again with the exception of the 1970 peak when finds were made in Alaska. Table 2 shows the estimates of natural gas supplies. Once again we see that the maximum estimate of the U.S. Geological Survey is the most optimistic. Again the Hubbert figure seems the most reasonable.

Domestic Petroleum Outlook for the Near Future

In 1956 (19 years ago), Hubbert predicted that domestic oil production would peak between 1966 and 1971. He was correct with his method of analysis; the peak did come in November, 1970, and production has been declining since. Hubbert also predicted that natural gas would peak in 1974-75, which is proving to be true at the time of this writing. Clearly, his method of analysis has something going for it. At the present time the United States domestic petroleum reserve (excluding Alaska reserves) is down to about nine years.

During this interval it is possible great strides could be made in establishing tertiary recovery, as well as in discovering alternate energy sources. In the meantime, great hopes have been attached to possible large discoveries offshore on the Atlantic coast. Exploratory work, upwards of $200 million worth, resulted in 65 drill sites in what are considered the most promising areas of the eastern continental shelf. But of these, 62 were dry holes. The oil showings in the remaining three were too small to warrant any production. For the short term, which is our major problem, the prognosis is very poor. Even if major new offshore fields were found, it takes up to seven years to develop them into production.

As we shall see in subsequent articles, prospects for alternative energy sources are indeed numerous. And, as stated earlier, there is no absolute shortage of petroleum at present, though for a decade at least we will have to change our energy-consuming patterns. We are fortunate that because of a combination of political events, economic conditions, and social and environmental events, we have received an early warning. There *is* an energy crisis, not one that is going to destroy us, but one which will give us pause to think and find solutions before a disastrous state does arrive. □

field briefs

Marshland scene by Charles F. Davis; see "Nature Photography Course," below.

Conference on Lake Michigan Status

The "State of the Lake" will be the topic addressed at an all-day conference at Field Museum on Wednesday, April 26. The Lake Michigan Federation is sponsoring the event to draw attention to the problems of the lake.

Toxic substances, pollution from dredging spoils, and transfer of pollutants from the atmosphere to the lake will be the primary technical topics discussed in the meeting room sessions. Additionally, visual aids, general information, and talks will be presented in the lecture room for the public and museum guests who do not prefer technical topics.

Environmental enforcement officials and public officials will involved in the program. The technical experts will discuss their research on toxic substances, polychlorinated biphenyls (PCBs) in particular; atmospheric pollutants transfer to the lake; and pollution from dredge spoils before a panel of officials who will then question the experts. The program will began at 9 a.m. and conclude about 4 p.m.

The "State of the Lake" conference will be part of a week-long series of events around the lake to draw attention to lake problems and to celebrate the fifth birthday of Lake Michigan Federation. The Federation is a private nonprofit environmental coalition of organizations in the four Lake Michigan states. The goal of the organization is to promote citizen participation in formulation of public policy decisions affecting the lake and its shorelands.

Nature Photography Course

An aesthetic approach to nature, via the camera lens, will be presented by Field Museum in a series of six sessions. Charles F. Davis, eminent Oak Park photographer and teacher, is guest lecturer. The sessions—limited to 25 persons—will be given on successive Saturdays: May 10, 17, 24, 31; June 7 and 14. Participants must be seriously inter-

ested in scenic photography, be proficient in color work, and have a full-frame 35 mm or larger format camera.

One-Day Program on Raptors

A special program on raptors (birds of prey) will be offered on Thursday, May 17, at Field Museum for junior high and senior high school students. It is to be sponsored jointly by the Museum and the Lincoln Park Zoological Society. The program will open at 10 a.m., in the Lecture Hall, with a film on the red-tailed hawk, a discussion, and a live animal demonstration. At 1 p.m. the program will offer "birding workshops," a museum tour of bird of prey exhibits, and a discussion with naturalists who have recently returned from Guyana, where they studied and filmed the harpy eagle. Portions of this rare film will also be shown. Bob Hinckley, Lincoln Park Zoo's curator of birds, will be a featured speaker. Those who wish to register for the morning workshop or who wish to have a registration form for the afternoon workshop should call 922-9410, ext. 352. Cost of the program is $1.00, to be paid at the Lecture Hall on arrival.

Jory Graham New PR Head

Field Museum's new public relations counsel is Jory Graham, well-known Chicago journalist and author. Most recently, Ms. Graham has been a columnist for the *Chicago Sun-Times* and a contributing editor for *The Chicagoan*. She is author of five books, including *Chicago: An Extraordinary Guide* (1968), a Chicago-area best-seller now in its fourth printing, and *Instant Chicago—How to Cope* (1973). She is currently revising the former, scheduled for publication early next year. As public relations counsel Ms. Graham succeeds G. Henry Ottery, who resigned.

Development Office Names Cliff Buzard

The new associate development officer for Field Museum is Clifford Buzard, who most recently served as director of communications at Rush-Presbyterian-St. Luke's Medical Center, in Chicago. Mr. Buzard is a thirty-year Chicagoan and a graduate of Northwestern University's Medill School of Journalism. He succeeds Kent Buell, who resigned to accept another position.

Harold Haydon (left), Chicago Sun-Times art critic, discusses the exhibit of ancient Ecuadorian artifacts, opening April 18, with Donald Collier, curator of Middle and South American archaeology and ethnology.

Don't Forget Members' Nights!

Mark a red circle on May 1 or 2 (Thursday and Friday) so that you will remember to attend Field Museum's Members' Night—on either of those nights. Open house will be from 6:00 to 10:00, with many special activities featured, in addition to refreshments and live entertainment in Stanley Field Hall. Duplicate programs will be offered on both evenings.

Buffet Opens Ecuador Exhibit

A gala buffet supper to inaugurate the opening of a new exhibit "Ancient Ecuador: Culture, Clay, and Creativity 3000-300 B.C." will be held at Field Museum on Thursday evening, April 17. The event is sponsored by the Women's Board of Field Museum and is open to nonmembers as well as members. Reservations may be made by sending in the coupon below (or facsimile thereof) with a check for the appropriate amount. For details of the exhibit, open to the public on April 18, see p. 8.

Field Museum
Ecuador Preview Supper
April 17, 1975

Name _____

Street _____

City _____ State _____ Zip ____

MEMBERS:
No. of tickets ($18.50 ea.) _____
Check enclosed for $ _____
(Price includes food and beverages)

NONMEMBERS:
No. of tickets ($22.50 ea.) _____
Check enclosed for $ _____
(Price includes food and beverages)

☐ I wish to become a member of Field Museum
☐ Check enclosed for Life Membership ($500)
☐ Check enclosed for Annual Family Membership ($15).

I am unable to attend the supper but wish to contribute $_____.

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APRIL and MAY at Field Museum

SPECIAL PROGRAMS

Continuing:

Craft Demonstrations and Discussions

"African Patterns," 10:00 a.m. to 12:00 noon, Mondays, Wednesdays, and Fridays. Entrance to Hall 27.

"The Ways of Our Ancestors: Traditions of Native North America," 10:00 a.m. to 12:00 noon and 2:00 to 5:00 p.m. Fridays. Hall 4.

Weaving demonstration by members of the North Shore Weavers' Guild from 10:00 a.m. to 12:00 noon on Mondays, Wednesdays, and Fridays. Spinning also shown on the first and third Mondays of each month. South Lounge.

Saturday Discovery Programs

A series of tours, demonstrations, and participatory activities offered by Museum volunteers between 11:00 a.m. and 3:00 p.m. includes Ancient Egypt, Prehistoric Man, Reptiles, Jewelry in Other Cultures, and Northwest Coast Art. For information on time, place, and topic inquire at Museum entrances.

Begins April 5:

Field Museum's Ray A. Kroc Environmental Education Program series, "Man Uses the Land."

Adult Field Trips:	April 19, **"Energy, Residence, and Recreation Systems."** Lakeshore priorities for energy, recreation, and community living will be explored. (Completely booked.) April 23, above program repeated.
Adult Courses:	April 5, **"Nature Photography."** The first of six Saturday programs (one course) on basics of nature photography.
Programs for Teachers:	April 19, **"The Dunes."** Field trip stressing ecological succession, field techniques, and national park facilities. April 26, **"The Vacant Lot."** Explores the kind of community most accessible to the urban school.
Family Mini-courses:	April 12, **"Here Today, Gone Tomorrow?"** Introductory museum program in morning; afternoon trip to Lincoln Park Zoo. April 19, above program repeated. April 23, **"Energy: Planning for the Future."** Family use of energy explored; trip to Bethlehem Steel plant.

Saturday, April 12

Programs by leading performing arts groups, including **The Chicago Brass Quintet, Dance Medium,** and **The Indian Trio,** 10:30 a.m. to 1:30 p.m., Stanley Field Hall. Sponsored by Young Audiences of Chicago.

Opens April 18

"Ancient Ecuador: Culture, Clay, and Creativity," an exhibition of pottery, jewelry, and tools dating from 3000-300 B.C. Hall 9.

April 19 to 27:

Spring Holiday Programs include:

Films at 11:00 a.m. and 1:00 p.m. daily, Hall 27 Studio.

"Fingertrips," a guessing game exploring the sense of touch, 1:00 to 4:30 p.m., April 22, 23, and 24, South Lounge.

"Environmental Awareness," a film-discussion program on endangered species, 10:30 to 11:15 a.m., April 22 and 24, Lecture Hall.

FILMS AND LECTURES

"Ascent of Man," free film series, presented at 2:00 p.m. Fridays and Sundays through April 20 in the Lecture Hall.

The one-hour films cover a time span of more than two million years in exploring scientific discoveries that have shaped human history.

April 4 and 6: "Knowledge or Uncertainty"
April 11 and 13: "Generation upon Generation"
April 18 and 20: "The Long Childhood"

Free Ayer Adult Illustrated Lecture Series, "Expeditions Unlimited 1975," presented by Field Museum curators at 7:30 p.m. Fridays and 2:30 p.m. Saturdays in Lecture Hall. Seating is limited to 225 persons. Museum cafeteria is open until 7:30 p.m. Fridays.

April 4 and 5: "Collecting Mosses in Southern Chile," by John Engel
April 11 and 12: "Ancient Ecuador: Culture, Clay, and Creativity," by Donald Collier

CHILDREN'S PROGRAM

Continuing:

Spring Journey for Children, "People of the Salmon and Cedar," a free, self-guided tour, routes youngsters to Museum exhibits relating to the Northwest Coast tribes. All boys and girls who can read and write may participate in the program. Journey sheets in English and Spanish available at entrances. Through May 31.

MEETINGS

April 4, 8:00 p.m.,	**Chicago Anthropological Society**
April 8, 7:00 p.m.,	**Nature Camera Club of Chicago**
April 8, 8:00 p.m.,	**Chicago Glider Club Council**
April 9, 7:00 p.m.,	**Chicago Ornithological Society**
April 9, 7:30 p.m.,	**Windy City Grotto, National Speleological Society**
April 10, 8:00 p.m.,	**Chicago Mountaineering Club**
April 20, 2:00 p.m.,	**Chicago Shell Club**

COMING IN MAY

May 1 and 2, **Field Museum's Members' Nights,** 6:00 to 10:00 p.m.

May 3, **Lelooska Carvers** perform

Field Museum's Ray A. Kroc Environmental Education Program series, "Man Uses the Land," continues.

Adult Field Trips: May 3, 7, **"Looking at Landscapes,"** preserving natural communities becomes more difficult as surburbia grows. May 10, 14, **"Farm Futures,"** life on suburban farms caught in the rural and urban interface. May 17, 21, **"Guarding the Future,"** Forest preserves try to balance the often conflicting needs for recreation and preservation. May 24, 28, **"Challenging Changes,"** garbage plus gravel makes a ski hill and an abandoned railroad right-of-way becomes a nature trail. May 31, **"Creating Diversity,"** a native prairie is threatened by development, and an overused forest preserve is transformed into an environmental education center.

Adult Courses: May 10, **"Landscape Photography,"** first session in series of six.

Programs for Teachers: May 10, **"The Stream,"** the varied character of Saw Mill Creek is observed. May 17, **"The Lake,"** a slide presentation on history and problems of Lake Michigan, followed by dipping net into Burnham Harbor. May 24, **"The Prairie,"** an opportunity to explore Wolf Road Prairie, an endangered prairie remnant.

Family Field Trips: May 17, 24, **"The Farm,"** a visit to hog farm and a dairy farm. May 31, **"The Forest,"** explore a pond, a forest, and other ecological communities in Palos Park.

Craft demonstrations and discussions

Saturday Discovery Programs

Weaving demonstrations

MUSEUM HOURS

Open 9:00 a.m. to 5:00 p.m. Saturday through Thursday and 9:00 a.m. to 9:00 p.m. Friday.

The Museum Library is open 9:00 a.m. to 4:00 p.m. Monday through Friday. Please obtain pass at reception desk, main floor north.

Museum telephone: 922-9410

May
1975

Field Museum of Natural History Bulletin

Field Museum of Natural History Bulletin

May 1975
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COVER

Two new species of tanager (shown ½ natural size), discovered in 1973 in Peru, that have been recently named and described by Emmet R. Blake, emeritus curator of birds at Field Museum, and Peter Hocking, a United States missionary stationed in Peru. The watercolor painting, reproduced courtesy of *The Wilson Bulletin,* is by John O'Neill, an ornithologist and distinguished bird painter of Louisiana State University, Baton Rouge, La.

The tanagers were collected by Peter Hocking and his Peruvian assistant, Manuel Villar. The smaller tanager, at the top, has been named rufous-browed hemispingus (*Hemispingus rufosuperciliaris*); the larger tanager has been named golden-backed mountain-tanager (*Buthraupis aureodorsalis*). Both species were found in the temperate zone of central Peru in the Acomayo-Carpish Ridge region of Depto. Huanuco. Specimens of the former were collected at 8,500 to 10,000 feet elevation; those of the latter were found at 10,500 to 11,500 feet. The original description of the new species appeared in the December, 1974, *Wilson Bulletin,* published by the Wilson Ornithological Society.

Photo Credits

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The author's watchful waiting pays off: a ground squirrel pops out of its hole.

Stalking the Siberian Ground Squirrel

by Nancy Nadler

"I see one!" yelled Robert, our nine-year-old son, as we settled into our Leningrad hotel room. He clambered stealthily onto the desk and with all the aplomb of a seasoned collector, swirled his insect net to snag a cockroach from the upper fringe of the window curtain.

Before leaving Chicago, in June, 1973, Robert and I had been briefed by Field Museum entomologists on how to catch and preserve insects. While not tangential to the purpose of the trip, our insect-collecting might prove of value, since the insect fauna of Siberia—where we were to spend most of the summer—is not well represented in United States collections. We were to bring back what insects we could to the Museum. Now we had our first acquisition: a droopy-antennaed cockroach, seemingly no different from the common American variety. But perhaps it was a rare mutant of some kind; young Robert's zeal was not to be dampened.

The main purpose of the trip, however, was to continue our comparative study of Asian and North American ground squirrels. We would look for certain differences in chromosomes, proteins, and skull structure that may have separately evolved in squirrel species of the two regions since Asia and North America became separate land masses nearly 13,000 years ago.

The ground squirrel study is of special interest to Soviet and American scientists because it is one of the few zoogeographic models in which related species can be compared with respect to their evolutionary divergence over a known period of time. The research was the first to be sponsored by the United States National Academy of Science and the Academy of Sciences of the U.S.S.R., with scientists of both countries collaborating.

The Soviet Academy had again invited my husband, Charles F. Nadler, and Robert S. Hoffman for another summer's work with Nikolai N. Vorontsov, at the Institute of Cytology and Genetics, Siberian Branch Academy of Sciences of the U.S.S.R. at Novosibirsk. Dr. Nadler is a Field Museum research associate in mammalogy and an associate professor of medicine at Northwestern University's School of Medicine; Dr. Hoffman is professor of systematics and ecology at the University of Kansas.

In addition to our nine-year-old entomologist, Robert, my husband and I were accompanied by Charles, Jr., sixteen; and

Nancy (Mrs. Charles F.) Nadler is secretary of the Women's Board of Field Museum and is a charter member of the group.

Charles Nadler (left) and colleague draw blood sample from anesthetized squirrel.

Tissue samples had to be examined in the field as well as in the laboratory.

our fourteen-year-old daughter, Carrie. Charles Jr. assisted in the work by analyzing blood proteins of captured squirrels. The Hoffmans were accompanied by three of their children. Sixteen-year-old John Hoffman measured skulls. Both boys were trained in their respective assignments before leaving the United States.

We remained in Leningrad for several days, measuring squirrel skulls in the Leningrad Museum's collection. Then off to Siberia for weeks of hard work.

As reported in the June, 1972, *Bulletin* ("Expedition into the USSR," p. 9), our first summer in the Soviet Union was spent in Akademgorodok, a "science town" on the outskirts of Novosibirsk, Siberia, and on field trips to the Altai Mountains and the Buryat Republic.

The scientific goals for our second trip were essentially three:

- To measure ground squirrel specimens in Soviet collections.
- To determine, by histological techniques, the distinctive banding patterns of chromosomes, particularly of the long-tailed ground squirrel. These techniques make possible an evaluation of chromosomal homology and a determination of ancestry relationships that had not been possible with techniques used earlier.
- To compare protein and enzyme electrophoresis patterns in Eurasian and North American ground squirrels of the genus *Spermophilus*. These data provide a means for evaluating genetic similarity between related species.

Most of the summer's laboratory work was done in Akademgorodok's Cytology and Genetics Institute. Many long days were spent standardizing laboratory methods, comparing one another's findings, and jointly writing up the results of the research.

As part of the cooperative arrangement, a one-bedroom apartment was provided in Akademgorodok for each of the two American families. As for myself, many hours were spent shopping—a time-consuming task that would try the patience of any housewife accustomed to the efficiencies of the American supermarket. In the Russian market I would queue up with the other women and await my turn for service. The customer would say how much she wanted—of butter, for example; it would be weighed and put aside. Then one entered the cashier's line, paid for the butter, got back in line at the butter counter, handed the clerk the receipt, and was then given the butter. In the cereal line the same routine was repeated; and so on, for other items. There was no such thing as packaging, as

American shoppers know it. Butter and cereal would be wrapped loosely in a flat sheet of paper, while other items, such as eggs and potatoes that required no wrapping, would be put in the string bag that every shopper carried to the market. As the weeks wore on, I gradually accepted the time-consuming routine, but learned to do my shopping when the lines would not be too long. After the second week, Mrs. Hoffman and I discovered the farmers' market, where farmers came in from the country to sell potatoes, carrots, berries, and flowers. Ice cream was sold at stands on the street, as were rolls stuffed with fried meat.

On weekends, together with Dr. Vorontsov, his wife Elena, and daughter Masha, we all took excursions into the country. One beautiful warm Sunday was spent boating, picnicking, and swimming on the Ob Reservoir. Robert and I were never without our butterfly net and we collected insects on every outing as well as in the forest-steppe habitat around Akademgorodok. We were free to wander alone wherever we wanted, and frequently hiked over the network of trails surrounding the town.

A highlight of the summer was a collecting trip to Yakutsk Autonomous Soviet Socialist Republic. After a five-hour flight from Novosibirsk we arrived at the republic's capital—also called Yakutsk—a city of some 100,000 located at a latitude just north of that of Anchorage, Alaska. About one-fourth of the more than one million square miles of the republic lies within the Arctic Circle. It is a largely forested area, with forests, mineral wealth, water resources, and gas and oil reserves as yet largely untapped.

At the Yakutsk airport we were met by Prof. I.P. Sherbakov, who led us on a tour of the Yakutsk Biological Institute. There, research problems are largely related to the local flora and fauna; studies of forest resources, and fur-bearing mammals and fishes are given special attention. The institute's laboratories are modern, well-equipped, and the projects sophisticated.

On the evening of our arrival, we strolled through Yakutsk's older, unpaved streets to view the picturesque early log buildings and houses with their ornately carved window borders. We also visited

Water was poured down a squirrel hole, then we stood tensely by, waiting for the animal to pop out—a method requiring a lot of water, a quick eye, and an even quicker hand.

The author (left) with husband and children in Red Square, Moscow.

The flower beds outside our apartment in Akademgorodok were a good source of butterflies for son Robert.

the remains of the old wooden fort of the early fur-trading community, a striking contrast to the modern construction now underway in the city.

Yakutsk, founded in 1632, is situated in the taiga, or coniferous forest, adjacent to the Lena River—the Soviet Union's second largest waterway. Dubiously, the region boasts a temperature range of nearly 200 degrees: -94°F. in winter and 100° in summer. Permafrost underlying the city thaws to just three feet below the surface during the summer, creating special problems for builders. All large, multistory buildings are built today on piles sunk well into the permanently frozen earth. An airspace between the elevated bottom of the building and the ground prevents building heat from melting the permafrost, for this would allow the structure to shift disastrously or sink.

On our second day in Yakutsk we traveled into the nearby taiga on the institute bus to collect ground squirrels (*Spermophilus undulatus jacutensis*) in some areas of relict steppe. Isolated far from the main distribution of the species, these animals were of special interest as a model for the effect of prolonged geographic isolation on chromosomal, protein, and cranial characteristics. In squirrels captured there we found moderate changes in proteins and skulls, but none in chromosomes. Our method of capture was simple but effective: water was poured down a squirrel hole, then we we stood tensely by, waiting for the animal to pop out—a method requiring a lot of water, a quick eye, and an even quicker hand—to say nothing of bite-proof gauntlets. In this way we managed to gather a good selection of ground squirrels.

That night we boarded a small ship and headed north down the Lena, which at this point is about half a mile wide. In the summer the river provides a vital route to the Arctic Ocean. In the winter, its thick frozen surface is used by tractor trains. Thanks to this year-round facility, towns and villages have sprung up along its length. In summer a hydrofoil boat skims back and forth, providing a "Lena rapid-transit" service to Yakutsk.

Awakened in the morning by the abrupt silence of the ship's engines, we peered out to find ourselves anchored next to a peninsula; we learned that we

were about forty miles north of Yakutsk. Here we remained for four days, collecting a large sample of ground squirrels from another relict-steppe locality. Robert, of course, did his own thing—industriously collecting insects for Field Museum.

Cooking was done in large buckets over an open fire on the bank of the river. While the men trapped squirrels, the children passed the time swimming and fishing. The grassy, willow-covered peninsula was cultivated by nearby villagers; interestingly, their farming methods resembled those of homesteaders in 19th-century America. Shaggy Yakut horses pulled sleds carrying redolent, freshly cut hay, which was then tossed onto haystacks with wooden pitchforks.

After a successful collecting trip, we chugged back to Yakutsk on our little ship, enjoying the panorama of vast unspoiled Siberian larch forest. Back in Akademgorodok we spent our final ten days doing laboratory studies of the specimens we had collected.

On the Lena River, 40 miles north of Yakutsk. For four days we collected squirrels not far from where the ship was moored. We spent the nights aboard ship.

On the basis of the summer's work, the scientists drew several main conclusions:

- The Arctic ground squirrel (*Spermophilus parryii*), the species with the most continuous distribution in the territory adjacent to the Bering Strait, displayed the greatest degree of skull, chromosomal, and biochemical similarity. The data we obtained support the view that Asian and Alaskan Arctic ground squirrels are still a single species after geographic isolation for 12,800 years.
- The long-tailed ground squirrel of Siberia (*S. undulatus*) and the Columbian ground squirrel (*S. columbianus*), the pair of species with a more remote transberingian (and hence longer period of) isolation, underwent greater cranial and genic divergence than Asian and North American *S. parryii*, although they retained indistinguishable chromosome complements after 100,000 years.
- The long-tailed ground squirrel group that included *S. parryii, S. undulatus,* and *S. columbianus* shared many skull and biochemical similarities with the North American "big-eared" ground squirrel group despite chromosomal differentiation within the latter group.
- The greatest chromosomal, biochemical and skull divergence occurred between certain Eurasian species of the subgenera *Colobotis* and *Spermophilus* and North American "big-eared" and "small-eared" species groups.
- Although comparisons between different sets of characters are difficult to correlate, evolutionary change in the ground squirrels we studied was greater for skull and biochemical characters than for chromosomes within a given time of geographic isolation.
- Finally, the concept of a Eurasian North American biogeographic region is strengthened by the demonstration of close affinities among the many characters studied in Eurasian and North American populations of *S. parryii,* in Siberian *S. undulatus,* and in North American *S. columbianus.*

Future joint studies with Dr. Vorontsov and his Soviet colleagues will compare similar types of data from other Asian and North American mammals including various genera of mice, wild sheep, and possibly human populations living in the vicinity of the Bering Strait. □

our environment

Federal Aid for Indiana Bat

The Indiana bat's chances for survival in the east central United States have recently been improved by the establishment of a team of experts who will give priority to restoring populations of this animal to their former healthy state. This bat is one of ten endangered species that have been selected by the U.S. Fish and Wildlife Service for priority treatment.

"Recovery teams" are being established for the American alligator, red wolf, eastern timber wolf, Delmarva fox squirrel, Kirtland's warbler, dusky seaside sparrow, Mississippi sandhill crane, Everglade kite, and blue pike. These are the first of an anticipated fifty such teams that will begin work on or after July 1, 1975, to rehabilitate endangered species populations. There are currently 109 animals listed as endangered in the United States.

The primary objective of the Indiana bat recovery team is to coordinate action to restore Indiana bat populations to a healthy balance in the wild after drawing up a detailed recovery plan which will schedule specific actions needed.

The Indiana bat (*Myotis sodalis*) is a medium-sized, grey-colored bat. The original range of the species extended from eastern Oklahoma to Vermont and as far south as Florida. Distribution is associated with limestone caves. The species may still be found over much of the same region, but in reduced numbers, and there is evidence that many previously occupied caves have been abandoned.

The primary reason for the decline of this bat, as well as for a number of other bat species, is disturbances of caves by man. Many thousands of bats have been killed outright by vandals, and other colonies have been disrupted by cave explorers or scientists. If people disturb hibernating bats in the winter, their temperature rises and thus the demand on their body fat rises. In many cases, because of disturbances, the bat has insufficient fat to sustain it through the remainder of the winter. In order to protect the Indiana bat, several roosting sites have been purchased by conservation agencies or barred from public access.

There is little question that this bat and its habitat are threatened by a number of man-induced factors, and conservation measures are fully warranted. Moreover, the problems of the Indiana bat exemplify the plight of many other species which depend on restricted habitats that are being increasingly subjected to detrimental influences of man.

Do I Hunt What?

As state and federal conservation offices seek information on the population status of various animal species, one of the techniques used is the telephone survey. Since 1967, some 20,000 phone calls have been made by the Southeastern Cooperative Fish and Game Statistics Project as they attempt to assess the status of the mourning dove in the southeastern states. A great deal of valuable data has thus been gained for the project, but the survey has also elicited responses which, for one reason or another, seemed deserving of notice. The girls who did the surveying would introduce the project with something like:

"We are calling from Raleigh, N.C., to conduct a study of mourning dove hunting for the game and fish departments of several southeastern states. Would you mind answering a few questions for us?"

A Tennessee hunter replied that he would not give any information to anyone from North Carolina. Other responses included the following:

"Whose husband died last season?"

"Daddy, it's important. It's a woman."
"You have the wrong number. We don't have any of that kinda stuff around here."

"Hunt doves? Yeah, I'll hunt doves with you."

"It's just me and my man living here and we're too old to do anything. He'll be 93 come April 5th and I'm 86. And I still do all my own wash."

"Yeah, he went hunting, but not in the morning."

"My ex-husband used to hunt them, but he doesn't live here anymore, thank goodness."

"No, nobody in this house hunts doves. Nobody in this house does anything."

"Nope, nobody hunts no doves 'round here. I kilt one, but he wuz in the corn stack eating the corn, and I kilt him with a ear o' corn."

"Am I on Candid Camera?"

"I'm sorry, he's on the commode."

"He just carried the slop out to the hogs—call back."

"I'm not interested in door openers. What in the world are door openers?"

"Are you calling from the funny farm? I may have hit a few with my car or my tennis racket. Do they count?"

"No, my husband couldn't hit the broad side of a barn if he was laying on it."

Grand Canyon View Threatened

The future of the Grand Canyon looks "hazy," according to biologists reporting the first signs of an air pollution problem for one of America's most famous national park areas.

Monitoring devices on the rim of the canyon show a definite increase in particles during the past three years. Although the canyon is still relatively unpolluted, its magnificent vistas are not as distinct as they once were.

Particulates are carried by wind hundreds of miles from Los Angeles and other cities. However, greater dangers to the park are posed by pollution from energy development in the Southwest. Within a 100-mile radius of the canyon, there are six huge coal-burning power plants either in use or under construction. Some 100,000 tons of coal soon will be burned each day by the plants to produce power for Phoenix, Los Angeles, and other cities. Just north of the canyon is the Navajo plant at Lake Powell, the world's largest power plant, which eventually will burn almost a fourth of those 100,000 tons—using coal from Black Mesa strip mine in Arizona.

Even if these plants could achieve federal air quality standards, which many observers doubt, the small percentage of total pollutants that escapes would spread a distressing mass of contaminants over the national park area.

MUSEUM VOLUNTEERS HONORED

One hundred ninety-eight Field Museum volunteers, with a total of 28,185 hours of service to the Museum in 1974, were honored at a reception in Stanley Field Hall on March 13.

The evening program included a buffet supper and dancing to music provided by the Stanley Field Hall Preservation Ensemble—an instrumental group consisting of Field Museum personnel. Museum Pro Musica, a three-member amateur ensemble, performed on the recorder. Cliff Abrams, of the Department of Exhibition, played the bagpipes and Lennie Carrion, Field Museum chief engineer, performed feats of magic and legerdemain. Hy Marx, curator of reptiles and amphibians, and Julie Castrop, of the Department of Education, coordinated the entertainment. Ed Olsen, curator of mineralogy, was master of ceremonies.

As a memento, Museum Director E. Leland Webber presented each volunteer with a chip of Georgian marble removed from the building structure during the Museum's rehabilitation program.

Volunteers who contributed the most hours during 1974 were Jim Swartchild (Anthropology), 1,237 hours; Alice Schneider (Anthropology), 1,168; Sol Gurewitz (Anthropology), 952; Walter Mockler (Geology), 872; John O'Brien (Education), 851; Louva Calhoun (Anthropology), 722 hours; Charles Henry (Geology), 686; Blair Winter (Zoology), 662; Col. M.E. Rada (Anthropology), 620; Maude Wahlman (Anthropology), 574; Bruce Jayne, (Zoology), 417; Phillip Hershkovitz (Zoology), 400; Claxton Howard (Library), 350; Alyce DeBlase (Zoology), 310; Jason Weil (Exhibition), 308 hours.

Other volunteers included:

Anthropology

Jean Armour
Carol Bendell
David Berglund
Susan Birnkrant
Royal Buscombe
Georgette D'Angelo
Carol Dodds
Eleanor G. Dugdale
Bonnie Elber
Natalie Firnhaber
Frances T. Freeman
Peter Gayford
Susan Hiestand
Deborah Idaka
Frederica Irvin
Bridget Jennings
Palmira Johnson
Adria Katz
Janet H. Kelley
John Kolar
Anne Leonard
Elizabeth Lilly
Sandra Moss
Henry Moy
Irene Q. Mullen
Anna Nadolski
Herta Newton
Noreen Rodman
Hilde Sachs
Elizabeth Searle
Alice Seeburg
Gertrude Silberman
Joanne Silver
Marwita Stone
Beatrice Swartchild
David Wend
Jan Wisseman
Reeva Wolfson
Eva Ziemba

Botany

Jean Boehme
Barbara Boyd
Jeane P. Cole
Karen Engel
Genevieve J. Kline
Linda Ramsden

Bulletin

Joyce Brukoff

Education

Sydney Allport
Marvin Benjamin
Phoebe Bentley
Leslie Beverly
Jean Bolton
Betty Bondy
Mary Brock
Linn Buss
Kathleen Carson
Theresa Cartmell
Jean Carton
Ruby Clark
Patience Cook
Velta Cukers
Barb Curcic
Mary Agnes Curran
Lynn Davis
Sharon DeBerry
Joseph de Cristofaro
Alice Eckley
Anne Ekman
Lee Erdman
Luis Estevez
Gerda Frank
Grace Fuller
Nancy Gerson
Helen Gornstein
Karen Grossman
Miguel A. Guzman
Lois Hewitt
Peter Hewitt
Audrey Hiller
Hazel Huggins
Ellen Hyndman
John Johnston
Julia Jordan
Myrette Katz
Marian Keith
Michael Kilgore
Janet G. Klauber
Paula Klein
Laurie Kosky
Dorine Kroll
Alfreda Leisz
Susan Lynch
Edna MacQuilkin
Dorothy Magos
Melba H. Mayo
Bettie McClelland
Carol Mudloff
Tom Mudloff
Natalie Newberger
Bernice Nordenberg
Noriko Okamoto
George Olson
Hazel Pensock
Ann Prewitt
Eleanor Quackenbush
Yvonne Robins
Anne Ross
Bonita Samuelson
Susie Saulter
Laura Seidman
Ann Shanower
Phyllis Sidwell
Bradford Sidwell
Irene Spensley
George L. Speros
Lorain Stephens
Hazel Turner
Jean Von Blohn
Phyllis Wiley
Barbara Wroblicky

Exhibition

Dylan Berger
Jeff Jacobs

Geology

Jeffrey Albiniak
Rudy Chavez
Lucy Davis
Terrence Frest
Gertrude M. Hannen
Robert Hicks
Linda Horn
William Krueger
Margaret S. Litten
Ruth Loucks
China Oughton
Samuel Silverstein
Eric Slusser
Patricia Talbot
Earle E. Wilson
Barbara Wolfson
Robert Zanon

Library

Arden Fredrick
Helen Pfeifer
Marie L. Rosenthal

Membership

Karen K. Morris

Publications

Carrie F. Anderson
Idessie Bowens

Zoology

Barbara Brown
Dorothy Brunken
Alice Burke
Jean W. Cameron
Stanley Dvorak
Millie Dybas
Robert Elmore
Betty Lou Girardi
Richard F. Guetzlaff
Mark Hershkovitz
Michael Hershkovitz
Barbara Hoff
Julie Hurvis
Dorothy Karall
Elizabeth Liebman
Millicent Marks
Margot T. Merrick
LeMoyne Mueller
Keelin Murphey
Daniel Polikoff
Alan Resetar
Pat Rogers

Members' Nights

Members' Nights at Field Museum are the most festive, exciting, and interesting events on the Museum's calendar. All members, and their families and friends are cordially invited by the Museum staff to visit on those very special evenings—May 1 and 2. Guests will have a once-a-year opportunity to view and take part in behind-the-scenes activities in the scientific, education, and exhibition departments. Programs for the two nights will be identical.

There will be games and craft participation for youngsters, tours, film and slide shows, the popular "Anthropology Game"—now in its third year, and taxidermy demonstrations. Guests will also have the opportunity to test their "environmental IQ," and to meet and chat with curators and other museum personnel.

At various locations on the Museum's six floors, staff members will also give demonstrations and/or lectures on snakes and dinosaurs, weaving techniques, African art, Chinese folk design, the coelacanth—a "living" fossil, insect collecting, pottery restoration, mushroom collecting, the collecting and preservation of flowering plants, the study of rocks through the microscope, a slide show and exhibition of newly excavated materials from Field Museum's National Science Foundation Summer Anthropology Program—and many, many more.

In Stanley Field Hall the Lelooska Carvers—a family of Native Americans—will give exciting dramatizations of Indian legends and demonstrate woodcarving and silversmithing techniques, of which they are consummate masters. (For more information on the Lelooskas, see p. 18.) In Hall 9, also on the first floor, guests can view the newly opened exhibition of ancient Ecuadorian

Thursday, May 1; Friday, May 2: 6-10 p.m.

pottery, including more than 600 clay artifacts—many of them exquisitely fashioned works of art. It is the first exhibition—anywhere—of this remarkable collection.

For those who wish a complete meal—or just a cup of coffee—the Museum cafeteria will be open from 6:00 to 8:00 p.m.

Free parking will be available in the Museum's lot just north of the north entrance and in Soldier Field lots just south and east of the Museum. Or, ride the free round-trip charter bus marked *Field Museum,* leaving every 30 minutes from the southwest corner of State and Jackson, stopping at the southwest corner of Michigan and Jackson, and the southeast corner of Michigan and Balbo; the bus will operate from 6:00 until Museum closing.

Lakeside daisy (*Actinea herbacea*)

Chicago's Rare Wildflowers

by Floyd Swink

How many species of flowering plants (native and introduced) are to be found in the Chicago area?. Well over 2,000. A good number of these are rare and localized, a fact that is in part explained by the variety of dissimilar geographic or geologic features within a relatively small area: the proximity of a great body of fresh water, high sand dunes along Lake Michigan, regions of rich corn-belt soil, sandy soils (as in the Kankakee River valley), and the occurrence of Niagaran dolomitic limestone near (or even at) the earth's surface.

Add to this the great modification of this area by man, and the impact of a very dense concentration of human population, it is easier to understand that many of these plant species have become even rarer.

"Rarity" of a species is used here only with respect to local occurrence, as most of the species under discussion are not so rare in other parts of their distribution range. The twelve species treated here are, of course, only a small sampling of the rarities eligible for discussion, but have been selected because of their exceptional beauty or for some other special attribute.

Lakeside daisy, or four-nerved starflower (*Actinea herbacea*). This attractive yellow-flowered member of the composite family blooms in spring, and is found in gravelly soils. It is known from only four places in the world—Mason County, Ill.; the shores of Lake Erie, near Sandusky, Ohio; Manitoulin Island, Ont. (in Lake Huron); and the area of our local interest: the village of Rockdale, near Joliet, in Will County, Ill. There are good-sized colonies of the flower in Rockdale, but they occur on industrial property very close to actual industry. Its associates there include beach wormwood (*Artemisia caudata*), sand coreopsis (*Coreopsis lanceolata*), shooting star (*Dodecatheon meadia*), purple coneflower (*Echinacea pallida*), false pennyroyal (*Isanthus brachiatus*), fringed puccoon (*Lithospermum incisum*), marbleseed (*Onosmodium hispidissimum*), scurfy pea (*Psoralea tenuiflora*), and hoary vervain (*Verbena stricta*). Some botanists place *Actinea* in the genus *Hymenoxys*.

Floyd Swink is taxonomist at Morton Arboretum, Lisle, Ill.

Orange-fringed orchid (*Habenaria ciliaris*). This is certainly one of America's most beautiful wildflowers, whose blossoms show curious resemblance to witches' heads. It still occurs in good numbers at the Pinhook Bog in La Porte County, Ind. Formerly, it occurred in the Goose Lake area of Porter County, Ind., until that area was taken over by industry. Probably the only existing Illinois locality today is in one of the Cook County forest preserves, where a number of plants still persist very close to a well-traveled interstate highway. Here the plants associate with rattlesnake master (*Eryngium yuccifolium*), alum root (*Heuchera richardsonii grayana*), wild quinine (*Parthenium integrifolium*), chokeberry (*Pyrus melanocarpa*), and prairie cord grass (*Spartina pectinata*).

Mead's milkweed (*Asclepias meadii*). This is one of our country's rarest plants. Only two localities were ever known in the Chicago area. One was at Crown Point, Ind., where it was collected by a Mr. Brannon in July, 1888. The other was a fairly recent discovery, made by William Rommel, in 1966, near Palatine, in Cook County. Unfortunately, this colony has recently been destroyed. Associates there include wild onion (*Allium canadense*), thimbleweed (*Anemone cylindrica*), smooth blue aster (*Aster laevis*), pasture thistle (*Cirsium discolor*), wild sunflower (*Helianthus maximiliani*), hoary puccoon (*Lithospermum canascens*), purple prairie clover (*Petalostemum purpureum*), Seneca snakeroot (*Polygala senega*), blue-eyed grass (*Sisyrinchium albidum*), stiff goldenrod (*Solidago rigida*), Indian grass (*Sorghastrum nutans*), prairie dropseed (*Sporobolus heterolepis*), and porcupine grass (*Stipa spartea*).

Milk vetch (*Astragalus neglectus*). This is our rarest species of milk vetch, and was thought for many years to be extinct in this area. Norman Fassett, of the University of Wisconsin, recorded that it had been collected at Barnes Prairie near Racine, Wis., in 1880 and 1881 by J. J. Davis, and that by 1934 the prairie had been destroyed and placed under cultivation. This was our only local record until 1971, when Ray Schulenberg and Catherine Ciolac of the Morton Arboretum discovered another locality for this rare plant near Somers in Kenosha County, Wis. Confirmation of the identification was made by Duane Isely of Iowa State University.

Dragon's mouth (*Arethusa bulbosa*). This beautiful orchid is now extinct in the Chicago area, but it still frequently occurs in the boggy areas of our northern states and Canada. It formerly grew in several areas near Gary, Ind. Perhaps the last observation of this plant in that state was recorded by Edwin Hull, writing in 1935 in the *American Botanist* (Vol. 41, p. 29):

> In 1933 several specimens were found in a bog at New Chicago . . . in 1934 this number had dwindled to two, and these were in a rather poor condition though flowering, growing in pure Sphagnum, and in the shade of Poison Sumac. It seems worthwhile to make a record of this orchid, since the two mentioned are probably the last specimens in the Indiana dune region, and possibly for the entire state.

Orange-fringed orchid (*Habenaria ciliaris*)

Buffalo berry (*Shepherdia canadensis*). Locally, this is one of our rarest shrubs, although it becomes common farther north. Perhaps only one specimen survives in all of Indiana, near Clark Road in Gary. Only a few plants survive near the lake Michigan beach at Glencoe, Ill., and in nearby Highland Park. Contrasting with this rarity, substantial numbers occur on Chicago's periphery, near Crestview, in Racine County, Wis. There it is found on calcareous clay bluffs, growing with spreading dogbane (*Apocynum androsaemifolium*), paper birch (*Betula papyrifera*), climbing bittersweet (*Celastrus scandens*), round-leaved dogwood (*Cornus rugosa*), stiff gentian (*Gentiana quinquefolia occidentalis*), witch-hazel (*Hamamelis virginiana*), red honeysuckle (*Lonicera dioica*), Canada mayflower (*Maianthemum canadense interius*), hop hornbeam (*Ostrya virginiana*), wood betony (*Pedicularis canadensis*), and basswood (*Tilia americana*).

Fame Flower (*Talinum rugospermum*). This pretty member of the purslane family is exceedingly rare here. For years, only two localities were known, both in Lake County, Ind., in parts of what is now Gary. These localities were known about 100 years ago; but both localities are now extinct. Then, in August 29, 1962, Richard Wason discovered this species in a Cook County forest preserve. It prefers a sandy soil, and some of its original Gary associates were little bluestem grass (*Andropogon scoparius*), three-awn grass (*Aristida tuberculosa*), butterfly weed (*Ascelepias tuberosa*), sand coreopsis (*Coreopsis lanceolata*), flowering spurge (*Euphorbia corollata*), rockrose (*Helianthemum canadense*), June grass (*Koeleria cristata*), fall witch grass (*Leptoloma cognatum*), rough blazing star (*Liatris aspera*), horse mint (*Monarda punctata villicaulis*), sand primrose (*Oenothera rhombipetala*), prickly pear cactus (*Opuntia humifusa*), sand club moss (*Selaginella rupestris*), and hoary pea (*Tephrosia virginiana*).

Dragon's mouth (*Arethusa bulbosa*)

Thismia americana. Unquestionably one of the most remarkable plants of the American flora, this species occurred only at Chicago (near Lake Calumet), and nowhere else in the world. It has not been seen alive in more than sixty years, and is now certainly extinct. By the use of a map supplied by Norma Pfeiffer, the plant's discoverer, I was able to discover the old habitat, and found that *Selaginella apoda* and most of the other associates mentioned by Pfeiffer (*Bot. Gaz.* 57:124, 1914) were still present.

For a number of years the area was searched for *Thismia*, but without success. Unfortunately, the land has been usurped by industry. To make the story even more fascinating, this interesting plant of the Burmannia family has as its closest relative a species that occurs only in New Zealand and Tasmania.

Kankakee mallow (*Iliamna remota*). The only place in the world where this species occurs as a native plant is on Altorf Island in the Kankakee River in Kankakee County. Other populations, such as the one in Elkhart County, Ind. were introduced by man. The closely related *Iliamna corei*, which occurs on Peters Mountain in Virginia, may actually be a variation of *I. remota*. At any rate, this population occurs naturally nowhere else in the world. The phytogeographic implications of these two disjunct species are of profound interest. Altorf Island has been badly abused by farming and grazing, but a goodly number of *Iliamna* plants continue to survive there. Earl Sherff has written interestingly about *Iliamna* in *Rhodora* (Vol. 48, p. 89, 1946).

Leafy prairie clover (*Petalostemum foliosum*). Until quite recently, this species was thought to be locally extinct. It had originally occurred in four northeastern Illinois counties, as well as in areas near Nashville, Tenn., and Russellville, Ala. Robert Betz, of Northeastern Illinois and a Research Associate at Field Museum, obtained information on the Tennessee population from Elsie Quarterman of Vanderbilt University, and was able to observe the plants in their native habitat. Then, last August, came the remarkable rediscovery of our local plants by Gerould Wilhelm of the Morton Arboretum, near Lockport in Will County.

Corn salad (*Valerianella chenopodiifolia*). Tens of thousands of these plants occur along Trail Creek south of U.S. 20 near Michigan City in La Porte County, Ind. They were originally reported by Earl Sherff in *Rhodora* (Vol. 48, p. 96, 1946) where he stated that one stand of them covering more than a quarter of an acre was so dense that it resembled a field of buckwheat in bloom. In spite of all this abundance, the plant is to be found hardly anywhere else in the Chicago region.

Death camass (*Zigadenus glaucus*). This species occurs locally in Berrien County, Mich.—the Michigan county closest to Chicago. In the nearer Chicago area it is only found at one locality in La Porte County, Ind., and at one locality near Elgin, in Kane County, Ill. The latter colony is in special jeopardy, as it is sandwiched between a railroad track and the Fox River, in a very narrow area. This is a species of calcareous springy places, and its associates include swamp thistle (*Cirsium muticum*), cotton grass (*Eriophorum angustifolium*), Joe Pye weed (*Eupatorium maculatum*), boneset (*Eupatorium perfoliatum*), gay feather (*Liatris spicata*), narrow-leaved loosestrife (*Lysimachia quadriflora*), winged loosestrife (*Lythrum alatum*), grass of Parnassus (*Parnassia glauca*), shrubby cinquefoil (*Potentilla fruticosa*), Ohio goldenrod (*Solidago ohioensis*), swamp goldenrod (*Solidago patula*), Riddell's goldenrod (*Solidago riddellii*), and valerian (*Valeriana ciliata*). □

Kankakee mallow (*Iliamna remota*)

books

PLANTS OF THE CHICAGO REGION, A Check List of the Vascular Flora of the Chicago Region with Notes on Local Distribution and Ecology.

Second Edition
By Floyd Swink
Published by the Morton Arboretum. $5.00.

The Chicago region presents many difficulties for the student of its flora and vegetation. Its early land forms were complex and resulted from the work of glaciers that formed moraines, outwash plains, drainage channels, deltas, distributary channels, flood plains, lakes, lake beaches, and complex dune formations. This early and varied landscape supported a rich flora and fauna. Beginning with settlement, the early vegetation was vastly modified by man-induced changes in the land forms as well as by introductions of foreign species and the elimination of native species through habitat modification. This already complex landscape was further modified by the development of a great city with its surrounding network of industries and services.

For thirty-five years Floyd Swink has been making careful observations and field notes on the vascular flora and the nature of plant communities in the twenty-two counties which have more than half their area located within a seventy-five mile radius of downtown Chicago. This tremendous catalogue consists of over 2,000 species of vascular plants, both native and introduced, which have been found growing wild in the Chicago region. Nearly 100 of these are rare species, while many others are common to every county.

In 1969 the Morton Arboretum published Floyd Swink's catalogue as the first edition of *Plants of the Chicago Region,* particularly recognizing its value as a documentation of plants in a giant industrial region where change, including devastation of nature, is a daily occurrence. The first edition of five hundred copies was exhausted within three years, and continued requests for the book, along with a significant accumulation of new data, have encouraged the production of a second edition. Like the first edition, it will serve as a research tool for botanists, ecologists, and planners for today and tomorrow; it will serve as a guide to the local plants for the citizen who yet holds hope for a better environment; it will serve as a reminder of the effects of civilization and industrialization on nature to men of the future.

This new edition includes about 80 new kinds of plants which had not been recorded in 1969, over 2,000 new county distribution records, new ecological data, especially association lists for many plants that had not been studied sufficiently by 1969, and blooming dates for a substantial number of the flowering plants. The alphabetical organization of the first edition is retained, with the thought that it will allow convenient everyday use by any student of the intermediate level or above and at the same time permit it to serve as a good reference work for professionals.

The catalogue includes plants from parts of four states: Wisconsin, Illinois, Indiana, and Michigan. Considerable information that has been scattered in botanical literature is brought together here in one volume along with the observations by Floyd Swink and his assistants concerning incidence, frequency, associated species, and habitats for any wild plant within the twenty-two county area.

Floyd Swink is taxonomist at the Morton Arboretum. For many years he has been widely recognized as an authority on the taxonomy of plants of the Chicago region. He studied with eminent leaders in this field, among them the late Charles Deam of Indiana and Julian Steyermark, formerly of Field Museum.

—Marion Hall, director of Morton Arboretum

Plants of the Chicago Region *is available at the Museum bookstore.*

SCANNING ELECTRON MICROSCOPY

SUMMER WORKSHOP

July 14 - August 8

Flea's foot as viewed through scanning electron microscope

Upper-level high school students and freshmen or sophomore college students will have the unusual opportunity to study the scanning electron microscope and its operation first-hand, during a four-week workshop this summer at Field Museum. They will spend one month working with staff scientists, during which they will learn the basics of scanning microscope theory and operation, specimen preparation techniques, and participate in biological or geological research.

Each student will: 1) prepare materials for study, 2) spend three half-days at the scanning microscope making observations and photographs with the SEM technician, and 3) work with a Museum scientist in interpreting results of his studies.

The areas of research in which a student may specialize are: flowering plants, liverworts, insects, mollusks, mammals, Paleozoic invertebrate fossils, and Tertiary invertebrate fossils.

Enrollment for the workshop is limited to eight students; the fee is $125.

Applications must be in by May 20, and should consist of a letter, stating the applicant's area of interest and background, and include a letter of recommendation from a science teacher. The application should be sent to: Betty Deis, Department of Education, Field Museum of Natural History; Roosevelt Road at Lake Shore Drive; Chicago, Ill. 60605.

field briefs

Lelooska performers (above and opposite)

Lelooskas Return

Last year, Field Museum was fortunate in being able to host the Lelooskas, an Indian family of skilled woodcarvers and silversmiths who also gave dramatic presentations of legends and masked dances of Northwest Coast Indians. This year the Lelooskas will return to the Museum for performances and demonstrations on Members' Nights (May 1 and 2) and on Saturday, May 3.

The Lelooska (which means "he who cuts with a knife," or "whittling boy") family comes to us from Portland, Oregon, where they are affiliated with the Oregon Museum of Science and Industry. Permission to perform the dances and tell out legends was granted to Lelooska by Indian families around Northern Vancouver Island and principally by Chief James Sewid, heriditary Chief of the Kwatkiutls at Alert Bay. It is in this context that the Lelooskas have recreated a Kwatkiutl village, including a potlach house, where the family lives and works near Portland. Here the ancient traditions, songs, and stories are also presented to thousands of Portland-area school children each year.

Lelooska's art is a living art. Lelooska feels "an unconscious force seemed to draw me towards that art because I didn't want to see it die out." Visitors to Field Museum will be able to see the artists at work, and also be able to buy the products of their crafts. Following is the schedule of events that will take place in Stanley Field Hall:

Thursday, May 1; 10:00-12:00 a.m.; 1:00-3:00 p.m.: Tsungani will carve masks; Shona Ha will create character dolls which depict the life and activities of the tribe; Patty Fawn will carve and fashion jewelry from silver, ivory, and bone; Na Que Se will create apple dolls; Yana will carve animals from pine. At 1:00 p.m. Lelooska will lead a public tour of the Northwest Coast exhibits in Hall 10. At 7:00 to 9:30 p.m. the artists will again demonstrate their crafts (described above). From 7:30 to 8:30 p.m. legends and masked dances of the Northwest Coast will be performed in Stanley Field Hall.

Friday, May 2, 10:30 a.m. to 11:30 a.m., legends and masked dances of the Northwest Coast will be performed in Stanley Field Hall. At 1:00 p.m. there will be a public tour of

Northwest Coast exhibits in Hall 10. From 1:00 to 4:00 p.m. the artists will demonstrate their crafts. From 7:00 to 9:30 p.m. legends and masked dances of the Northwest Coast will be performed.

Saturday, May 3, 11:00 a.m. to 1:00 p.m., demonstrations by the artists. From 2:00 to 3:00 p.m., dances of the Northwest Coast and legends will be performed in Stanley Field Hall.

Slide Program on Birds

"Away with Wings" is the title of a special program to be given during the May 13 (Tuesday) evening meeting of the Nature Camera Club of Chicago. Presented by Alma and Benjamin Goldstein, noted Chicago-area bird photographers, the program will feature slide sequences depicting how birds feed, breed, and relate to their habitat, to each other, and to man. The program begins at 7:30, in the Lecture Hall, and is open to nonmembers as well as to members of the Nature Camera Club of Chicago.

Museum Editor Honored

Patricia M. Williams, managing editor of Field Museum's scientific publications, has recently been honored by the Friends of American Writers, a Chicago-based organization, in recognition for her book *Museums of Natural History and the people who work in them*. The organization's Juvenile Book Award Committee presented a $100 special award of merit to Mrs. Williams at an awards luncheon held April 9 at the Lake Shore Club of Chicago. Mrs. Williams book, which is on sale at the Museum bookshop, was published in 1974 by St. Martin's Press.

Hirohito Book Received

The latest monograph on marine biology by Japan's Emperor Hirohito is *Some Hydrozoans of the Bonin Islands*. A complimentary copy of the 55-page work has been given Field Museum by the Japanese government. The subject of the book, Hydrozoa, is a class of the invertebrate phylum Coelenterata, and most commonly exemplified by the freshwater hydra or the saltwater Portuguese man-of-war. The Bonin Islands, the locale of Hirohito's study, lie about 1,000 miles south of Tokyo Bay.

Hirohito is widely recognized as an amateur marine biologist. The Museum library already has two of his earlier works: one on seashells of Sagami Bay (Japan), the other on Sagami Bay sea-stars. Like the earlier two, *Some Hydrozoans of the Bonin Islands* is a technical treatise, of primary interest to the specialist.

Urban Streams Course

A five-week course on the character and ecology of Chicago-area streams will be offered by Field Museum from July 21 through August 22. The course, limited to twenty participants, will be predicated on work done twenty years ago by Field Museum's curator of fishes. Student research teams will revisit selected streams, conduct faunal surveys, and make comparative studies and analyses of twenty years of stream changes. The course will aim not only to provide an academic approach to the subject at hand, but will also attempt to give the student an opportunity to experience the rigor and the standards that are involved in a real-world research project.

The course will entail one week's instruction in field skills, three weeks of experience in the field, and a final week for preparation of a slide show and a report.

The teaching staff will include James Bland, an instructor in Field Museum's Department of Education; John Dorkin, a graduate student at the University of Illinois; and Anita Belik, science teacher in the Bourbonnais, Illinois, school system. Several guest lecturers have also been invited. Loren Woods, Field Museum curator of fishes, is consultant to the program. The fee for the five-week program is $25.

Applications may be obtained by calling 922-9410, Ext. 352, or by writing James Bland, Department of Education, Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago, Ill. 60605.

ILLINOIS NATURAL HISTORY
SURVEY LIB RM 196
NATURAL RESOURCES BUILDING
URBANA ILL 61801

MAY and JUNE at Field Museum

EXHIBITS

Continuing:

Ancient Ecuador: Culture, Clay, and Creativity, a special bilingual exhibition, continues through August 5. Hall 9.

The exhibition includes some 600 objects dating from 3000-300 B.C., and reveals a civilization at least 1,000 years older than any previously known in the Western Hemisphere.

Field Museum's Anniversary Exhibit continues indefinitely. "A Sense of Wonder" offers thought-provoking prose and poetry associated with the physical, biological, and cultural aspects of nature; "A Sense of History" presents a graphic portrayal of the Museum's past; and "A Sense of Discovery" shows examples of research conducted by Museum scientists. Hall 3.

SPECIAL PROGRAMS

Continuing:

Craft Demonstrations and Discussions

"African Patterns," 10:00 a.m. to 12:00 noon, Mondays, Wednesdays, and Fridays. Entrance to Hall 27. Through June.

"The Ways of Our Ancestors: Traditions of Native North America," 10:00 a.m. to 12:00 noon and 2:00 to 5:00 p.m. Fridays. Hall 4. Through June.

Weaving demonstration by members of the North Shore Weavers' Guild from 10:00 a.m. to 12:00 noon on Mondays, Wednesdays, and Fridays. Spinning also shown on the first and third Mondays of each month. South Lounge. Through May 16.

Saturday Discovery Programs

A series of tours, demonstrations, and participatory activities offered by Museum volunteers between 11:00 a.m. and 3:00 p.m. includes Ancient Egypt, Prehistoric Man, Reptiles, Jewelry in Other Cultures, and Northwest Coast Art. For information on time, place, and topic inquire at Museum entrances.

Field Museum's Ray A. Kroc Environmental Program series, "Man Uses the Land," continues:

Adult Field Trips: May 3, 7, **"Looking at Landscapes,"** preserving natural communities becomes more difficult as suburbia grows. May 10, 14, **"Farm Futures"** life on suburban farms caught in the rural and urban interface. May 17, 21, **"Guarding the Future,"** Forest preserves try to balance the often conflicting needs for recreation and presevation. May 24, 28, **"Challenging Changes,"** garbage plus gravel makes a ski hill and an abandoned railroad right-of-way becomes a nature trail. May 31, **"Creating Diversity,"** a native prairie is threatened by development, and an overused forest preserve is transformed into an environmental education center.

Programs for Teachers: May 10, **"The Stream,"** the varied character of Saw Mill Creek is observed. May 17, **"The Lake,"** a slide presentation on history and problems of Lake Michigan, followed by dipping net into Burnham Harbor. May 24, **The Prairie,"** an opportunity to explore Wolf Road Prairie, and endangered prairie remnant.

Family Field Trips: May 17, 24, **"The Farm,"** a visit to hog farm and a dairy farm. May 31, **"The Forest,"** explore a pond, a forest, and other ecological communities in Palos Park.

May 1 and 2:

Members' Nights: the annual open house for members of the Museum features special programs of entertainment, films, and behind-the-scenes activities in the scientific, education, and exhibition departments from 6:00 to 10:00 p.m.

May 1, 2, 3:

Lelooska Carvers, from the state of Washington, perform Native American dances, dramatize Indian legends, and demonstrate woodcarving and silversmithing; their artwork will be available for purchase.

CHILDREN'S PROGRAM

Continuing:

Spring Journey for Children, "People of the Salmon and Cedar," a free, self-guided tour, routes youngsters to Museum exhibits relating to the Northwest Coast tribes. All boys and girls who can read and write may participate in the program. Journey sheets in English and Spanish available at entrances. Through May 31.

MEETINGS

May 2, 8:00 p.m.,	**Chicago Anthropological Society**
May 13, 7:00 p.m.,	**Nature Camera Club of Chicago**
May 14, 7:00 p.m.,	**Chicago Ornithological Society**
May 14, 7:30 p.m.,	**Windy City Grotto, National Speleological Society**
May 18, 2:00 p.m.,	**Chicago Shell Club**

COMING IN JUNE

Ancient Ecuador: Culture, Clay, and Creativity, 3000-300 B.C. Exhibition continues.

Field Museum's Anniversary Exhibit continues.

Craft demonstrations and discussions

Saturday Discovery Programs

Weaving demonstrations

MUSEUM HOURS

Open 9:00 a.m. to 6:00 p.m. Saturday through Thursday and 9:00 a.m. to 9:00 p.m. Friday.

The Museum Library is open 9:00 a.m. to 4:00 p.m. Monday through Friday. Please obtain pass at reception desk, main floor north.
Museum telephone: 922-9410

June
1975

Field Museum of Natural History Bulletin

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COVER

Red-eyed tree frog (*Agalychnis callidryas*), found in southern Mexico and Central America. Specimen shown was photographed in Costa Rica by Hy Marx, curator of reptiles and amphibians; enlarged about 3X. The frog inhabits humid, usually montane forests, where it breeds in woodland pools. Maximum body length attained is about 2.5 inches.

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Hunting Behavior in Two Similar Species of Social Canids

by L. David Mech

The Canidae as a family of carnivores has been remarkably successful in colonizing most of the land area of the earth. With some 14 living genera, family representatives thrive on every continent except Antarctica. Individual member species occupy remarkably diverse ecological niches, with some species functioning basically as hunters and others as scavengers. Some are almost tiny, and others much larger. Several are solitary-living, whereas a few are social.

Two of the social species, the gray wolf (*Canis lupus*) and the African, or Cape, hunting dog (*Lycaon pictus*), stand out in occupying similar ecological niches but on opposite sides of the globe. The wolf originally inhabited most of the North Temperate and North Frigid Zones in North America and Eurasia, whereas the hunting dog lives in the Torrid and South Temperate Zones of Africa. Thus, the climate, soils, flora, and fauna differ substantially in the ranges of these two canids. Nevertheless, both the wolf and the hunting dog face the same problem: securing a livelihood by preying on large ungulates.

Because of the similarity of the ecological problem but in the light of differences in the environmental circumstances faced by the wolf and the hunting dog, it should be enlightening to examine the behavioral and ecological solutions that the two species have evolved. Therefore, the wolf and the hunting dog will be compared here in terms of their traits and habits most related to the problem of hunting, killing and feeding upon large ungulates.

Physical Attributes

Physically, the wolf and the hunting dog are quite similar, being long-legged and larger than most of the other canids. Adult wolves weigh from 60 to 120 pounds (27 to 54 kg), with 175 pounds (80 kg) being the heaviest on record. Adult hunting dogs range from 40 to 60 pounds (18 to 27 kg). The faces of each species are typically canid, but hunting dogs have much larger ears, while wolves possess longer noses.

These differences in the external portions of the sensory organs may reflect differences in the relative importance of the various senses of these two species. Wolves in wooded areas rely considerably on their sense of smell to locate prey, although in open areas vision sometimes becomes important.

Hunting dogs, coursing the open plains of Africa, depend primarily on vision and presumably hearing to locate and follow their prey, although in bush country they may also use their olfactory sense. Probably their heavy reliance on vision is the cause of their basically diurnal hunting. Wolves hunt day or night.

The African, or cape, hunting dog; male [left] and female

Social Behavior

Both wolves and hunting dogs hunt in packs, which allows them to locate, chase, kill, and consume large animals most efficiently. Most packs of wolves range in size from 2 to 12, and the largest pack reliably reported contained 36. For hunting dogs, Estes and Goddard concluded that 4 to 6 would be the minimum effective pack size, and packs of 21 or more are known.

In wolves, packs are basically family groups, with several successive litters or occasionally concurrent litters making up the larger packs, and this probably is also true of hunting dogs. Thus, in both species the skills of stalking and killing prey are easily learned as the pups and yearlings accompany the adults on their hunting forays.

Within packs both of wolves and of hunting dogs a dominance hierarchy not only helps maintain order but also aids in hunting. I have observed that the lead wolf in a pack of 15 is the most highly motivated in pursuit of moose (*Alces alces*), and Estes and Goddard noted that it was the lead hunting dogs that singled out certain members of herds of prey. By concentrating on an individual, a pack can focus all it attention on that individual and thus increase the chances of success. This requires that some pack member must be commonly accepted by

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"Hunting Behavior in Two Similar Species of Canids" is from The Wild Canids, edited by M. W. Fox. ©1975 by Litton Educational Publishing, Inc. Reprinted by permission of Van Nostrand Reinhold Company.

Gray wolf, male yearling

the others as the one to single out the prey animal.

As part of their social natures, wolves and hunting dogs communicate within their packs through a rich repertoire of vocalizations, and these also add to the species' hunting success. Howling among wolves helps separated pack members to get together quickly and the same appears to be true of the "contact call" or "hooing" of hunting dogs. "Twittering" by hunting dogs just before or during a chase is thought to foster concerted pack action. Similarly, it is widely believed by laymen that wolves "yip" when pursuing prey, although this contention has not yet been documented.

Both wolves and hunting dogs also communicate through scent-marking by urine and feces. Scent-marking is thought to help advertise and reinforce the dominant pack members and thus strengthen the social order, and also to mark areas used by each pack and perhaps help exclude neighboring packs.

The exact nature of the spacing of adjacent packs is unknown for both wolves and hunting dogs. However, an increasing amount of evidence is accumulating that wolf packs are basically territorial, with pack territories ranging in size from approximately 64 to 384 square kilometers (25 to 150 square miles) in Minnesota, for instance. In Alaska, where the degree to which wolf packs are territorial has not yet been established, one pack traveled an area of some 12,800 square kilometers (5,000 square miles).

Much less is known about the spacing and home range sizes of hunting dog packs. The van Lawick-Goodalls believe that these packs are not strictly territorial but that several packs may wander over a large area. They give range sizes of 1,280 to 3,840 square kilometers (500 to 1,500 square miles) for individual packs, but do imply that when one pack is occupying a certain area temporarily other packs will not intrude there. Whatever the case, it is apparent that both the spatial territories of wolves and the postulated spatiotemporal territories of hunting dogs would be of considerable advantage in reducing competition for prey.

Food Utilization

Because hunting dogs are somewhat smaller than wolves, on the average it would be expected that they would require somewhat less prey to sustain themselves, and this actually seems to the case. Estimated food consumption rates for wolves vary from 2.6 kg (5.6 pounds) to 6.3 kg (13.9 pounds) per wolf per day. For hunting dogs, the estimated rates are 2.0 to 4.0 kg (4.5 to 9.0 pounds) per dog per day. When put on a common base, however, the estimated consumption rates for both wolves and hunting dogs compare very favorably (0.09 to 0.19 kg food per kg of wolf and 0.11 to 0.15 kg food per kg of dog).

It should be obvious from the traits discussed above of both the wolf and the African hunting dog that they are very similar animals. Therefore, it should not be surprising that the actual hunting behavior of these two canids is also very much alike.

Hunting Behavior

Wolves and hunting dogs engage in a similar type of social behavior before beginning a hunt. Murie described the ritual in wolves as follows: "Considerable ceremony often precedes the departure for the hunt. Usually there is a general get-together and much tail-wagging," and this ceremony sometimes terminates in a group howl. For hunting dogs, Estes and Goddard described similar behavior: "Play and chasing tended to become progressively wilder and reached a climax when the whole pack milled together in a circle and gave the twittering call in unison."

After this group ceremony, which is very similar to the food-begging ceremony of pups and which may serve to motivate the leaders to the hunt, the pack members trot off in search of prey. At this time, individuals of either species may snatch small prey and devour it immediately. However, the packs are clearly programmed to concentrate on large animals.

In an earlier study (1970) I classified the hunting behavior of solves into several stages, and it is evident from the accounts of Estes and Goddard that comparable stages exist in the hunts of the African dogs. The first stage is *prey location*. As discussed earlier, in open areas both species use their vision, but in wooded areas they resort to olfaction, and perhaps to hearing. Little has been reported about the distance that hunting dogs can smell prey, but wolves can detect certain prey at distances of a kilometer or more.

After sensing prey, the packs of both canids begin the *stalk*, during which the individuals approach deliberately, with their attention focused on the prey. "The dogs appeared to be attempting to get as close as possible without alarming the game, and certainly the flight distances were much less than when the pack appeared running."[1] "The wolves sneak as close as they can to the prey without making it flee."[2]

The next stage of the hunt is the *encounter*, when the prey and predator confront each other, often at a distance. With larger prey of either the wolf or the hunting dog, for instance, moose and wildebeest (*Connochaetes taurinus*), re-

1. Estes, R. D. and Goddard, J. See "Additional Readings," below.

2. Mech, L. D. (1970). See "Additional Readings," below.

spectively, the prey may stand their ground as the predators approach and may aggressively defend themselves. Smaller prey species, however, usually flee. The moment they do, this activity triggers the urge in the hunters to bolt after them, in the *rush* stage of the hunt.

The rush gives the hunters their best head start toward the prey and may determine the ultimate outcome. Usually this stage continues into the *chase*. During the chase, hunting dogs and wolves perform quite comparably, running at speeds of 35 to 40 mph (56.3 to 64.4 kmph). The lead animals direct the pursuit, with most of the other members following. If in a group of fleeing prey certain individuals falter or fall behind, they are the ones likely to be attacked. Murie documented this with wolves chasing caribou (*Rangifer tarandus*), and van Lawick-Goodall concluded from watching numerous hunts by hunting dogs that they "select an individual from the herd that is, in some way, weaker and slower than his fellows."

The chases by either wolves or hunting dogs do not usually last long or cover great distances. Generally wolves give up if not successful within about 3 km (2 miles), and only rarely do they persist for more than about 5 km (3 miles). Hunting dog chases cover an average of 1.6 to 3.2 km (1 to 2 miles).

Of course, neither wolves nor hunting dogs succeed during every hunt. Wolves hunting the solitary moose on Isle Royale in Lake Superior during winter had a success rate of about 8 percent. Wolves preying on deer (*Odocoileus virginianus*) in Ontario succeeded in an estimated 25 percent of their hunts during one winter and in 63 percent during another, although these estimates may be higher than the actual success rates. Hunting success figures reported for the hunting dog range from about 34 percent to 85 percent. It must be stressed that success rates reported for wolves are usually from hunts involving only single prey animals or those in groups of up to four, whereas the figures from hunting dogs usually involved attacks upon herds of prey, where there were many more prey individuals that might be vulnerable.

When packs of hunting dogs or wolves do catch up with prey, they attack the animals in similar fashion. Both generally throw down smaller prey such as deer or gazelles (*Gazella thompsonii*) and tear at them anywhere. Usually they attack larger animals such as moose or wildebeest from behind, in the rump, flank, or hindlegs.

Parellels even exist in a further, very specific tactic used by both wolves and hunting dogs when attacking larger prey. One wolf will often grab a moose by the nose and hold it, while the rest of the pack works on its rump. Compare this with the following description of hunting dogs attacking a zebra (*Equus burchelli*) from van Lawick-Goodall: "One dog seizes the upper lip and pulls hard whilst the rest of the pack disembowels the prey."

In feeding, both wolves and hunting dogs bite into the rump and the abdomen of their prey. They arrange themselves side-by-side around the carcass and tear at it in every direction. With large packs, even the largest prey may be devoured in minutes.

At this point, a further similarity in the ecological niches of these two large social canids becomes apparent: both species have their attendant mammalian and avian scavengers that share their prey with them. In keeping with the greater diversity of the tropical ecosystems, more species of scavengers are associated with hunting dogs, but the basic parallel remains. Hyenas (*Crocuta crocuta*) and jackals (*Canis* spp.) dart in and out among the dogs, snatching pieces of the carcass, and various vultures descend upon it from the sky. With wolves, such species as foxes (*Vulpes* spp.), fishers (*Martes pennanti*), and wildcats (*Lynx* spp.) share the spoils, although they usually wait until the wolves are resting at a distance. Ravens (*Corvus corax*) and eagles (*Haliaeetus leucocephalus*) float above the kills of the wolves, and I once watched a lone wolf, an eagle, and several ravens all sharing a fresh carcass.

Conclusions

The similarities outlined above in the ecological niches of the wolf and the hunting dog, in the social behavior of these two species, in their basic physical attributes, and in their hunting behavior are striking. There is no question that each species is the direct ecological counterpart of the other in distant geographic areas. Despite the widely different environmental circumstances faced by both, they have solved the same ecological problem in remarkably similar ways.

Indeed, the similarities in the behavior of the wolf and the hunting dog even call into question the taxonomic status of the two species. Although placed in separate genera, they seem to be so similar that one wonders if they should both be considered *Canis*. □

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The Gypsy Moth Comes to Illinois

by David M. Walsten

It's taken more than a century, but the gypsy moth *(Porthetria dispar)*—that scourge of shade, fruit, and woodland trees—has finally chewed its way into Cook County. In 1869, the European moth was brought to the United States for experimental purposes—and, unfortunately, some of the insects escaped. Within a few years the moth established itself as one of our most destructive insect pests, gradually spreading north, west, and south of Medford, Mass., where it first gained freedom.

In 1973, gypsy moths were seen for the first time in Illinois. All were caught in traps located in Will County, Palos and Worth Townships (Cook County), Springfield, and Rock Island—one moth in each location. In 1974, 15,000 to 20,000 traps were set up throughout Illinois, and eleven moths were captured—all in southern Cook County. The captured insects, all males, were baited with synthetic sex attractant of the type secreted by the female. (Female gypsy moths are so heavy-bodied that they are unable to fly; thus, they are not easily trapped.) According to a formula based on observed gypsy moth increases in other areas, Illinois Department of Agriculture entomologists expect about 40 gypsies to be trapped in Illinois in 1975. Both Wisconsin and Missouri reported one moth captured in 1973 and none in 1974. Indiana reported none for 1974.

In the eastern tier of states the insect continues rampant, but the area defoliated by the gypsy moth fluctuates greatly from year to year. In 1953, 1,487,000 acres were defoliated, but two years later the total affected area was only 52,000 acres. In 1969, the figure was 255,800 acres, and in 1973, 1,773,846 acres were defoliated. Deciduous trees are not always killed by defoliation, but they are rendered especially vulnerable to the shoestring fungus *(Armillaria mellea)* and to attack by a beetle, the two-lined chestnut borer *(Argilus bilineatus)*. Evergreens will die if completely defoliated, since they are unable to replace their needles. A century of devastating New England's forestland has significantly affected the ecological balance of that region. Most tree stands susceptible to gypsy moth feeding have been greatly reduced and replaced by species more resistant to, or not favored by, the moth.

A number of environmental factors have a significant effect on gypsy moth populations; and these factors, in turn, will vary in intensity from one year to the next. Winter temperatures below −20°F kill gypsy moth eggs that are unprotected by snow or other cover. Late spring frosts may destroy newly hatched larvae. Many caterpillars die of starvation when they have eaten up the available foilage. Various predators, such as parasitic invertebrates, birds, and small mammals, add to the toll. Viral and bacterial diseases also affect the larvae.

The caterpillars are very easy to please when it comes to diet. Like most other defoliators, though, they have distinct food preferences. All larval stages grow and develop best on oaks, willows, poplars, most birches, larch, linden, and apple. The older larvae, but not the early instars, also thrive on chestnut, hemlock, pines, and spruces. A single 2-inch caterpillar eats a square foot of leaf surface every 24 hours. In heavily infested areas, whole trees may be stripped overnight. Larvae are able to survive, but few thrive on, cherries, elms, hickories, maples, or black or yellow birch. Even when they are starving, however, they usually turn up their noses at butternut, walnut, locust, sycamore, yellow poplar, and ash.

The female lays her eggs in masses of 100 to 1,000 or more in midsummer. Most often they are deposited on bark, fallen trees, in cavities in branches or tree trunks, or on stones. If they are laid on automobiles, trailers, or on the tents of campers, they may be transported hundreds of miles and start new colonies. "Hitchhikers" have been found as far south as Georgia and Alabama and as far west as California. The egg mass is covered with buff-colored hair and scales from the moth's body. The following spring the eggs hatch, and by late June or early July the larvae are full grown. Tiny caterpillars can be carried by the wind as far as twenty miles. The full-grown male caterpillar is about 1½ inches long; the female may grow to more than 2 inches. The caterpillar body has an irregular mottling of black, gray, and cream, creating a general grayish effect. Tufts of brown or black bristles extend from each body segment. The bristles, like the hair of many caterpillars, are highly irritating to human skin.

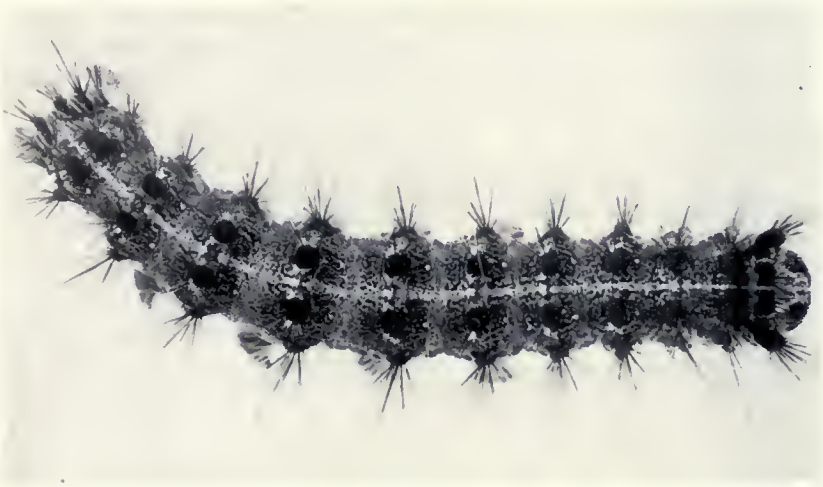
The reddish-brown pupal stage lasts for about 10 to 15 days. The male moth, about 1½ to 2 inches in wingspread, is light to dark-brown. The forewings of the slightly larger female are mostly white, with wavy, thin, brown bands. Mating occurs shortly after the moths emerge. The males fly vigorously in a zigzag course on warm days and may travel a considerable distance in locating the female. There is one generation a year.

The safest insecticide for use against

the gypsy moth over large areas is carbaryl, which is applied by mist blower or aircraft. It is poisonous to man, however, and especially toxic to bees. For a smaller number of trees a highly effective, but expensive weapon is the bacterium *Bacillus thuringiensis*, commonly known as Bt; like carbaryl, Bt is applied as a spray. Unlike carbaryl, it is harmless to most forms of life, including man.

Other control techniques currently being used by the U.S. Department of Agriculture and state agencies include (1) the importation, rearing, and release of predators and parasites that help control gypsy moth numbers in other parts of the world; (2) quarantines to prevent the movement of infested goods and materials that might spread the pest to new areas; (3) the treating of campgrounds in the infested Northeast to eliminate the pests before they can hitchhike on recreational vehicles; (4) limited aerial and ground treatments where necessary to protect valuable recreation and timber resources; and (5) the use of sex lure traps to keep track of pest population buildups and spread.

Three species of gypsy moth parasites —a fly and two wasps—were recently introduced from Spain for establishment in the United States. Prior to introduction they were evaluated by Department of Agriculture entomologists to ensure that they, too, would not become pests. Disease-producing organisms and the use of male moths made sterile by gamma radiation are also being explored as possible control measures. □



The gypsy moth (Porthetria dispar) *in various life stages. The caterpillar, upper left, shown about twice natural size, is mottled with black, gray, and cream. The adult male moth, upper right, is 1½-2 inches in wingspread. The adult female, lower right, is slightly larger in wingspread than the male but is unable to fly. The egg mass, lower left, shown about twice natural size, may contain as many as 1,000 eggs. Shown on facing page are a female pupa and a cast larval skin, about natural size.*

Bronze statue of cat from ancient Egypt; 47 cm. high. Cat. No. 30286. On view in Case 16, Hall J. Between the ears is a scarab amulet of silver, now mostly oxidized. Gift of Watson F. Blair.

A Cat in Bronze

by Paul Remeczki

> Each time she glanced at me the moonlight was mirrored in her eyes. I would have drawn her into my arms, but she pushed me away saying, "Do you not know why Bast, the goddess of love, is portrayed as a cat?"
>
> "I care neither for cats nor gods," said I, reaching out to her, my eyes blurred with desire. She pushed my hands aside.
>
> "Quite soon you may touch me . . . but first you shall listen to me and learn why a woman is like a cat and why passion, too, is like a cat. Its paws are soft, but they hide claws that rip and tear and stab mercilessly into your heart . . ." [1]

This explanation by the celebrated Finnish novelist Mika Waltari of why Bastet, the ancient Egyptian goddess of love, was portrayed in the guise of a cat may seem fanciful, but it may also be accurate. It is well known that the Egyptian pantheon included many divinities with human torsos topped by the head of some animal that was deemed sacred. In some cases it is easy to connect or relate the attributes of a particular animal to the characteristics of a certain deity; in other instances the logic of the ancient mind remains to us obscure. In a few cases there may be historically-based reasons for the association of a god with a particular animal.

Although we can only guess the reasons, we do recognize that the domestic cat was sacred to Bastet, the ancient Egyptian goddess of physical and romantic love, of pleasure, joy, festivity, music, and the dance. There were other Egyptian goddesses of love, most notably Isis and Hathor, but their special

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Paul Remeczki is a specialist in Egyptian archaeology and has served as a volunteer in the Department of Anthropology.

province was familial love—such as wifely and motherly love—and in that should not be confused with the role of Bastet. Our cat-headed goddess was also regarded as a protective divinity, perhaps partly because the cat helped to keep the farmer's fields and home clear of pests such as snakes and rodents; she kindly protected man against contagious diseases and evil spirits. Also, she was considered to represent the benevolent force of the sun's radiating light and heat; she presided over its ability to give warmth and illumination, to help the crops to grow and to be of general benefit to mankind in varous ways. In this she should not be confused with another feline deity, the lion- or lioness-headed Sekhmet, the Egyptian goddess of wrath and vengeance, who had dominion over the destructive aspects of the sun. Actually it is simple enough to equate the tame domestic cat with joy, love, and benevolence and its leonine cousin with the related, though opposite, principles of destruction, hatred, and violence. Although there is a relation between Bastet and Sekhmet, that very tangled and touchy problem of Egyptian religion is beyond the scope of this discussion, and we can only comment summarily on the presence of the various members of the cat family in the mythology and art of ancient Egypt.

The earliest known representations of felines on Egyptian artifacts date from Dynasty I (ca. 3100 B.C.). At the beginning of this century the noted archaeologist Sir W. M. Flinders Petrie was excavating the archaic royal tombs at Abydos. In the tomb of the Pharaoh Den he found two fragments bearing depictions of catlike animals climbing up standards; the identification of these two vague animals as cats is likely but not absolutely certain.[2] Also among his finds from the I Dynasty tombs at Abydos come two joined fragments of a crystal cup on which is named and pictured the earliest known feline goddess of ancient Egypt, the leonine Mafdet.[3]

A few other depictions of Mafdet occur in early Egyptian art and there is mention of her name in early inscriptions, possibly even indicating that she was regarded specifically as a cat goddess by the late Old Kingdom,[4] but the first mention of the goddess Bastet, the divinity we are primarily concerned with here, seems to be in the III Dynasty tomb of the royal son Nefermaat at Meidum, where he refers to himself as a priest of Bast. The name Bast has been translated as "the soul of Isis."[5] Our first actual picture of her, from two dynasties later, is found at the temple of King Ni-user-re at Abusir, where she is depicted". . . as a plain-robed, lion-headed deity, honored as 'Bastet, Lady of Ankh-Taui'."[6] The earliest cat and cat-headed amulets seem to date from the First Intermediate Period,[7] but the first actual coupling of the name of Bastet with the cat—as opposed to the lion—doesn't seem to be of any earlier than some scarabs of the XVIII Dynasty, and the earliest known depiction of her as a cat-headed, human-bodied goddess seems to be somewhat later in the Papyrus of Dirpu.[8]

Bastet soared to prominence as a great national divinity during the XXII Dynasty when pharaohs of Libyan origin ascended the throne and made the city of Bubastis in the Delta their capital.

Bubastis was the capital of a nome, or province, of Lower Egypt and had been the primary cult center of the goddess's worship. The name is a Greek corruption of Per-Bast, or "House of Bast."

The worship of Bastet was also particularly prominent during the XXVI Dynasty, and many of the artifacts related to cats and to the deity's worship exhibited in museums today date from this period. The popularity of her cult continued throughout antiquity and didn't officially end until A.D. 392 when the Christian Byzantine Emperor Theodosius I outlawed all paganism.

For many centuries, however, the cat goddess Bastet was an important one to the Egyptian populace. So, too, was the sun god Re in his guise as the male cat; in this form he slays the nefarious serpent Apophis, whose evil intent was to swallow the sun and so deprive man of its great benefit.

Bastet was regarded as daughter to Re and wife to Ptah, the great creator god of Memphis, and she and Ptah were usually considered as the parents of the gods Nefertem and Mahes, although Sekhmet at times replaced her in these feminine roles in the Memphite pantheon.

Even though she was an important goddess at Memphis and On, her major cult center remained at Bubastis where she was regarded as wife to Temu, a solar god. There was her splendid temple which was the abode of the living domestic cats sacred to her. The cat in ancient Egypt was sacrosanct, and killing one could mean the murderer's death. When cats did die they were regularly embalmed, often placed in coffins and buried with due ceremony in special cemeteries consecrated to them. The huge cat necropolis at Bubastis was famous, as was the one in Middle Egypt at Beni Hasan. At the latter place the goddess was worshipped as Pasht or Pakhet; on the east bank a rock-cut temple known in Classical times as the Speos Artemidos was dedicated to her.

The cemetery at Beni Hasan was accidentally discovered in the summer of 1888 by a farmer who was digging a hole near the ancient shrine; his spade suddenly exposed the mummies of cats. An apparent eyewitness describes the unscientific—not to say sacrilegious—excavation of the site by the native peasants:

> The plundering of the cemetery was a sight to see, but one had to stand well to windward. The village children came from day to day and provided themselves with the most attractive mummies they could find. These they took down to the river bank to sell for the smallest coin to passing travelers. Often they took to playing or fighting together with them on the way, and then the ancient fur began to fly as for three thousand years it had never been called upon to do. The path became strewn with mummy cloth and bits of cats' skulls and bones and fur in horrid profusion, and the wind blew the fragments about and carried the stink afar. This was only the illicit part of the business. The bulk of the old totems went another way. Some contractor came along and offered so much a pound for their bones to make into something—soap or tooth-powder, I dare say, or even paint. So men went systematically to work, peeled cat after cat of its wrappings, stripped off the brittle fur, and piled the bones in black heaps a yard or more high, looking from the distance like a kind of rotting haycocks scattered on the sandy plain. The rags and other refuse, it appears, make excellent manure, and donkey loads of them were carried off to the fields to serve that useful, if unromantic, purpose.

Bronze statuette of lion-headed goddess on view in Case 16, Hall J, 61 cm. high. Cat. No. 31642. Oblique view shown on facing page.

> It cannot be too much regretted that no responsible Egyptologist watched the excavation of this extraordinary burying-place. ThE fellahin were left to do it after their own fashion. Fortunately they know that every 'antica' has a money value, and these, therefore, they hoard for sale. But no record as to how they were buried is forthcoming. . . .[9]

The salvaging of some of the cat mummies from the various cemeteries has allowed for anatomical study, which, coupled with representations in art, gives us more precise knowledge of the type of cat that actually lived in ancient Egypt.

It is generally believed that two somewhat distinct types of cat occurred in Egypt. The one which was earlier attested in art was a largish wild or semi-wild cat with long ears and a sharp nose. The earliest uncontestable depiction of this animal in Egyptian art is in a bas relief scene of wildlife in the marshes dating from the V Dynasty; that relief is now preserved at The Vatican. The predatory wild cat is shown climbing among the papyrus as it stalks a nest of fledglings.[10] The other cat variety is a slightly smaller domesticated animal with shorter ears and a blunter nose. Various mammalogists have attached different zoological labels to the cats of ancient Egypt; however, they seem likely to be classified as *Felis maniculata* and *F. maniculata* var. *domestica*.[11]

A tabby coat of yellowish tan with dark markings was the most common; although other coats, especially gray, were also to be found. It would appear that the modern breed most closely resembling the common cat of ancient Egypt is that which today is known as Abyssinian.

It may be that the complicated patterned wrappings of certain cat mummies in which alternating bands of light and dark linen are alternated may be an attempt at quasi-abstract representation of the pattern of the cat's fur. Several examples of this may be seen in Field Museum's collection of mummified fauna in Case 6 of Hall J, the gallery of Egyptian antiquities. Actually only three of the twelve cat mummy bundles on display here contain the complete remains of deceased cats. Two are almost complete; four more include some feline remains, but the other three are total shams, faked by the ancient embalmers for their own purposes.

Where the Egyptian cat originated is not definitely known, but most evidence seems to point to Libya. When it actually arrived in Egypt is also uncertain. Evidence pointing to dates as early as the 1st Dynasty remains unconvincing. Cats do uncontestably appear on relief sculpture of the Vth Dynasty, but these seem wild rather than domestic. The earliest inscriptional evidence is from the VIth Dynasty. Except for the amulets of the 1st Intermediate Period noted above, no other items of inscriptional or artistic evidence are known until the Middle Kingdom. These include a group of cats from a tomb at Abydos which were buried alongside small pots containing offerings of milk, indicating that the true domestic cat was present at least as early as the Middle Kingdom. It does not become common, however, until the eve of the New Kingdom when, in the XVIIIth Dynasty, small felines at last seem to have attained wide popularity as household pets.

As such, the domestic cat—known onomatopoetically as *miu* in the Egyptian language—figures often in the decorative murals painted in Theban tombs, where it magically helps perpetuate the familiar life of this world in the beyond. Many paintings from the New Kingdom portray the feline pet seated beneath his master's chair. In the tomb of Nakht for instance, is depicted a scrawny tawny tabby munching away on a brightly colored fish.

Probably the most celebrated ancient Egyptian painting of a cat is one that appears on a fragment now in The British Museum (No. 37977). This magnificent creature has gone afowling in the marshes with his master and is helping to retrieve the bird brought down in the hunt, a rather stunning act caught splendidly by the artist.

An interesting bit of art history concerns the arresting adult cat painted in the tomb of Ipuy. The ancient artists who painted the tomb walls couldn't afford costly papyrus on which to do preliminary sketches so they drew on free and abundant ostraca: old potsherds and bits of limestone flaked off in the hewing of the nearby rock-cut sepulchres. Back in the 1930s while French archaeologists

were excavating at Deir el Medineh, the village where the Theban necropolis workers lived, they came across the very ostracon[12] on which was delineated the original sketch for the representation of this cat by the artist of over 3,000 years ago.

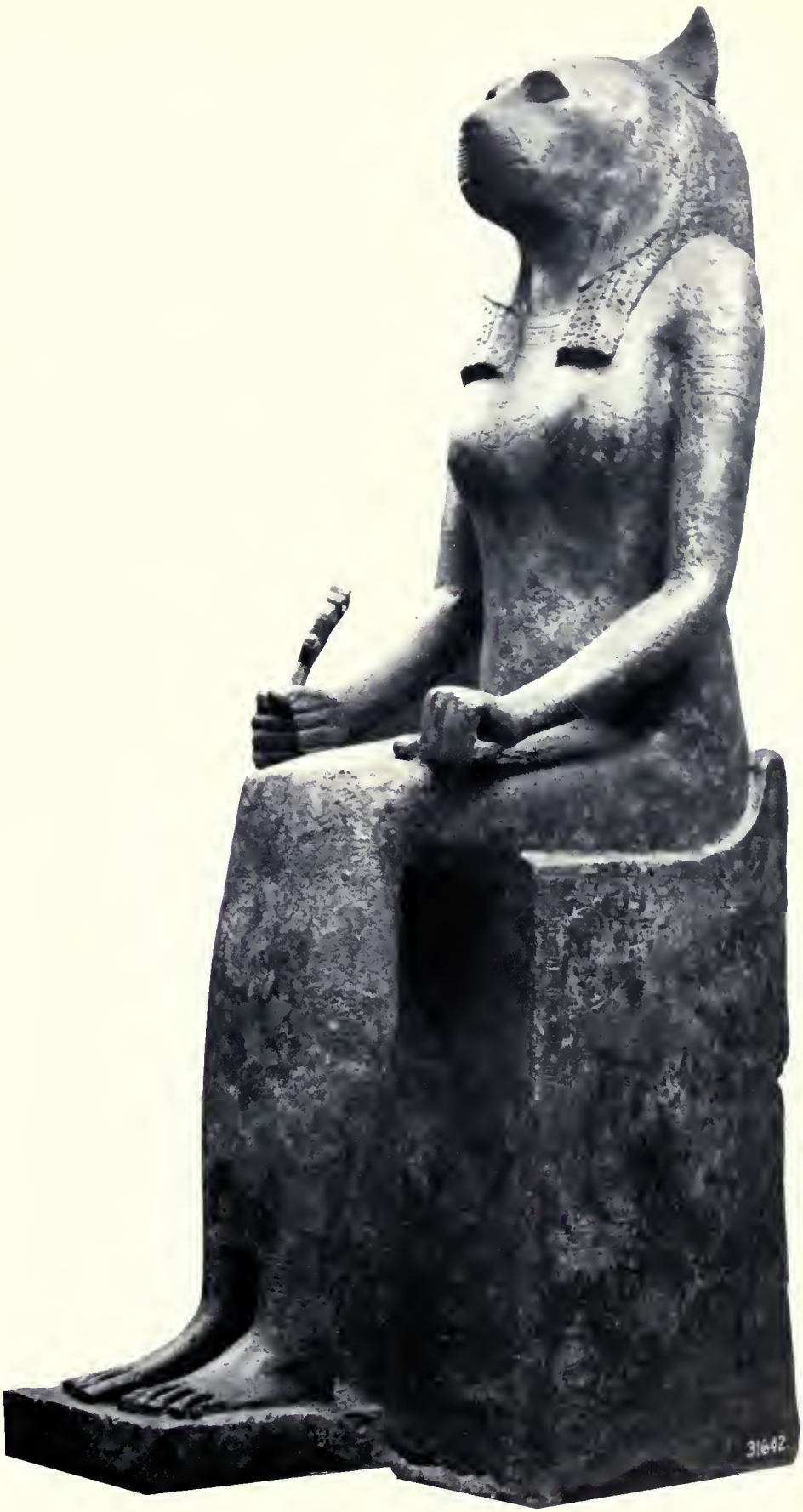
Egyptian artists depicted cats elsewhere also. They are shown, for example, in satirical papyri performing human acts; they were engraved on ivory magical wands used in rituals against serpents; they figure as ornamental elements in furniture and jewelry design and were carved in miniature as the marking pieces moved about in certain games played on boards.

Their most frequent appearance in sculpture-in-the-round, however, is in connection with the cult of Bastet. Figures of cats were fashioned in many materials, including precious metals, bronze, stone, wood, and faience. Life-size statues of cats in bronze are to be seen in many museums today, and it is one such that originally prompted the writing of this article.

Actually, the main reason for this brief treatise on the cat in ancient Egypt is a deeper appreciation by a larger number of persons of one of the great treasures of the Field Museum. Any sensitive visitor to Hall J cannot but be struck when walking past Case 16 by the large bronze cat (Cat. No. 30286) staring out from its barrier of glass and time.

It has an immediate appeal, partly because the object is the image of a cat, but largely because of the profound skill of the masterful sculptor who fashioned this unspeakably superb creation of the art of ancient Egypt.

As a magnificent object of art it readily demands appreciation. Here the artist has captured for all time the true essence of the cat. It sits in dignity and yet in repose. It is eminently conscious and alert and yet serene. It is awesome in aspect and yet approachable. One is intrigued by the graceful elegance of its sinuous lines. The spectator looks at its noble features and can't help feeling that the creature knows something that he does not. The cat itself, however, does not return the glance of the viewer, even at eye-level; for it gazes, not at one, but through and beyond one. In its presence one is aware of both the beautiful and the divine



The lovely creature is a testimony to the aesthetics and piety of ancient Egypt. As an artifact it tells us even more of the long distant culture which engendered it. X-ray examination has revealed that its interior apparently contains a bundle. Such large hollow figures of cats were often cast to serve as the coffins of the mummified cats interred in the holy cemeteries such as those at Bubastis and Beni Hasan. Others were used in domestic worship of Bastet or were dedicated as ex-votes in her temples.

Such statuary was at times bejeweled, and our cat sports a scarab on its forehead and an *uskh* necklace and *udjet*-eye pendant as amulet engraved around its throat; it may once have worn gold loop earrings.

There are other stately Egyptian cats in art museums throughout the world, but Field Museum's ranks among the very finest, comparing favorably with those to be seen anywhere else.

Besides this rather predominant statue, there are several other bronze sculptures concerning the cat on view in the Egyptian hall. Two are exhibited directly behind the large cat in Case 16.

Just to its rear is to be seen a charming little miniature group of an adult cat with two kittens (Cat No. 30285). This is also of the Saite Period and probably had a connection with Bastet.

The goddess herself is portrayed next in line in a bronze statuette (Cat. No. 30287). She is shown cat-headed and wearing a tight gown. Bastet was portrayed either entirely as a cat, as a human but with the head of a cat, with a human body but with cat's head and hind legs, or with a human body, cat's head, and cat's forelegs and hind legs, with or without tail. This particular statuette represents her holding her usual attributes; with a basket slung over one arm, she carries her "aegis" in one hand and a sistrum in the other.

The purpose of the basket is unknown. Sir Flinders Petrie suggested that it was used for carrying the sacred cats or kittens around in the temple;[13] however, knowing the independent nature of the animal, one tends to doubt this explanation.

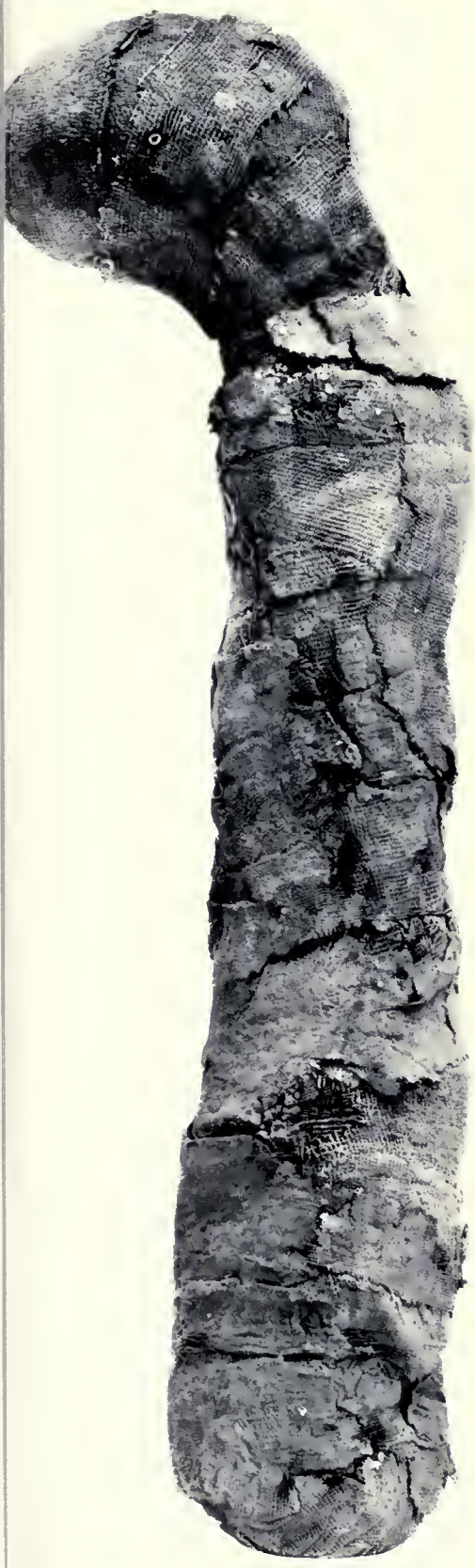
The aegis consists of a device of a head wearing a headdress and *uskh* collar. The meaning of this piece of the deity's iconography is quite vague, and an investigation of it is beyond our scope here.

Her third item is a sistrum, the rattle-like musical instrument played during various Egyptian religious rituals.

Indeed, the fourth cat-related object on exhibition in Hall J is an actual bronze sistrum (Cat. No. 173239) to be seen in Case 24. It is decorated with figures of various divinities, and at the very top reclines a mother cat with her litter of kittens. Bastet has associations with some of these other divinities, especially with the folk god Bes.

The fascinating cat goddess of ancient Egypt is thus represented by a small but interesting variety of objects in Field Museum's collection. We are curious to hear the sound of the sistrum; we are amused by the appealing mother cat and her kittens; we are intrigued by the iconography of the semi-animalistic representation of Bastet, but ultimately it is the large bronze figure of the cat that captivates us. We are allured and baffled by its mein. We look upon its expression and are not quite sure just what to

Assorted cat mummies in Field Museum's collection.



think—or feel—or believe. We feel that the cat is conscious of our presence but pays us not much mind. It is intent upon its own affairs as it sits gracefully and serenely in its case gazing out into eternity.[14] □

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1. Mike Waltari, *The Egyptian*, G. P. Putnam's Sons, New York, 1949, p.74.

2. N. and B. Langton, *The Cat in Ancient Egypt*, Cambridge University, Cambridge, England, 1940, pp. 1-2; Sir W. M. Flinders Petrie, *The Royal Tombs of the First Dynasty*, Egypt Exploration Fund, London, 1900-1901, vol. I, pl. XXXII, no. 39 and vol. II, pl. VII, no. 7.

3. Langton, *Cat*, p. 2; Petrie, *Royal Tombs*, vol. I, pl. VII, no. 4 and vol. II, pl. VII, no. 10.

4. Alan H. Gardiner, "The Mansion of Life and The Master of the King's Largess," *Journal of Egyptian Archaeology*, vol. XXIV, part 1, June 1938, pp. 89-90.

5. Neville Langton, "Bast—The Cat Goddess," *Antiquarian Quarterly*, vol. I, no. 4, Dec. 1925, pp. 93-4.

6. Langton, *Cat*, p. 64.

7. Langton, *Cat*, p. 2.

8. Langton, *Cat*, p. 64.

9. Wm. Martin Conway, *Dawn of Art in the Ancient World*, Percivalt & Co., London, 1891, pp. 182-3.

10. Hermann Ranke, *The Art of Ancient Egypt*, Phaidon, Vienna, 1936, pl. 189.

11. So Claude Gaillard and Georges Daressy, *La Faune momifiée de l'antique Egypte* (=*Catalogue Général . . .*), L'Institut Francais d'Archéologie Orientale, Cairo, 1905, p. 8 and L.-C. Lortet and C. Gaillard, *La Faune momifiée de l'ancienne Égypte* (=*Archives du Muséum d'histoire naturelle de Lyon*, vol. 8, no. 2), Henri Georg, Lyon, 1903, pp. 21 ff.; these two works should be consulted for a zoological discussion of the cat in ancient Egypt; cf. also Langton, *Cat*, p. 5.

12. Ostraca nos. 2809 and 2810, cf. Jeanne Vandier d'Abbadie, *Catalogue des Ostraca figurés de Deir el Médineh* (=*Documents de fouilles . . .*, vol. II), I. F. A. O., Cairo, 1936, 1937, 1946, 1959.

13. Langton, *Cat*, p. 73.

14. This short article is certainly not meant to be a definitive study of the cat in ancient Egypt; for further information, interested readers are referred to the works by Neville Langton, mentioned above, plus several of his other articles: "Cats in Egypt," *A. Q.*, vol. I, no. 3, Sept. 1925, pp. 68-74; "Further Notes on Some Egyptian Figures of Cats," *J. E. A.*, vol. XXIV, pt. 1, June 1938, pp. 54-8 and "Notes on Some Small Egyptian Figures of Cats," *J. E. A.*, vol. XXII, 1936, pp. 115-120.

X-ray of cat mummy

our environment

Musk ox

Alaskan Musk Oxen Airlifted to Siberia

Forty musk oxen were recently captured on Nunivak Island, west of the Alaska mainland, and airlifted by Soviet air transports to Siberia where they are extinct, in fulfillment of another part of the U.S.-U.S.S.R. Environmental Protection Agreement of 1972. Other cooperative efforts with the Soviets deal with cooperative polar bear and caribou studies, banding and dyeing snow geese that migrate between the two countries, a trip by American scientists to Russia to study the Siberian polecat and ground squirrels, and a trip by Soviet scientists to wildlife research facilities in this country involving the migration of birds.

The original population of the musk ox in Alaska was hunted to extinction by the middle of the last century. The re-establishment of the animal began in the 1930s when 31 of the oxen purchased from Greenland were placed on Nunivak Island, which had been reserved as a national wildlife refuge. The Nunivak herd today numbers about 700.

The U.S. Fish and Wildlife Service cooperates with the Alaska Department of Fish and Game in the management of musk oxen. Originally, the herd was completely protected on Nunivak National Wildlife Refuge, but as it reached the limit of its food supply, population control measures became imperative. The immediate, but temporary, solution to controlling the population was to transplant excess animals to their original ranges in arctic Alaska. Thus, the transfer of these 40 to the Soviet Union will provide further benefit to the Alaska herd.

Musk oxen have proved easier to capture than many other animals. Eskimos, on their swift snow machines, can quickly corner a herd and capture any selected animal by placing a large net over it. It is then sledded as far as 50 miles to the Eskimo village of Mekoryuk, where it is temporarily penned to await transport to the mainland by aircraft. The musk oxen airlifted by the Russians were placed along the easternmost coast of Siberia across from Alaska.

The habitat of the musk ox is so remote that, until a short time ago, knowledge of its behavior and way of life depended on tales of early hunters, hearsay accounts, or reports of brief encounters by explorers. Scientists call it *Ovibos*, literally "sheep-cow," but it is neither, nor is it very closely related to either of these animals. Its closest, but still distant, living relative is the *takin* of Tibet and Burma.

Ancestors of the musk ox evolved on the arctic prairies, steppes, or tundra of north-central Asia about a million years ago. During the ice ages, when vast glaciers lowered oceans, musk oxen crossed to North America on the land bridge which joined Asia and Alaska. They moved south with the glaciers as far as Iowa and New York, living then in habitat similar to that which they now occupy. As the glaciers retreated, habitats in southern latitudes changed, and musk oxen survived only in the northernmost tundra regions of North America and Greenland. It became extinct in Asia and Europe, perhaps because of changes in climate, but many scientists believe that primitive man contributed significantly to its demise there as in Alaska.

When white men first penetrated arctic regions, they found the musk ox abundant along coasts of northern and eastern Greenland, and in tundra areas of northern Canada, particularly in the arctic islands of that country. As more white men, mostly whalers and traders, penetrated the arctic, and Eskimos were provided with firearms, musk ox populations were rapidly depleted. Between 1850 and 1920, they were killed indiscriminately for food, or merely for robes, which were exported by hundreds from Canada and Greenland. Explorers slaughtered large numbers on the arctic islands to sustain their expeditions.

Protection was initiated in some areas of Canada at the opening of the century, but measures were not effective in most regions until after 1920. After several decades of protection, the recovery of the population is virtually complete, and numbers in most portions of their range probably equals that when white men first intruded. In mainland areas of Canada there are now more than 1,500 musk oxen, in Canada's arctic islands more than 5,000, and perhaps as many in Greenland. They also have been introduced into Norway and Spitzbergen.

The favored habitat of the musk ox is a land that ecologists call the "high arctic." This is the extreme northern fringe of tundra, bordering on polar seas, where night and winter, or day and summer, are synonymous. Plant life is frequenlty sparse and much of the ground surface may be bare. All vegetation is low-growing and even shrubs are dwarfed or creeping.

Amazingly, an important factor permitting their existence is lack of snow. The high arctic is a virtual desert, with annual precipitation of less than 10 inches. Snowfall may be less than 10 inches and is seldom more than 30. Strong winds deposit huge drifts in sheltered areas, leaving much of the ground bare. In the few arctic regions of deep snow, musk oxen do not occur.

Physical adaptations of musk oxen to their habitat are chiefly those which protect it from cold. Most important is its coat, which consists of a thick layer of cashmere-like wool, called "quiviut." The quiviut is protected by an outer coat of long, coarse hair which may reach three feet or more in length, and gives the shaggy appearance which is perhaps the basis of its Eskimo name, *Oomingmuk*, or "bearded one."

Musk oxen are a social animal and graze in small herds usually varying from three to 15 animals, but sometimes many more. During summer, herds consist of an adult bull with his harem of cows, calves, and immature animals. Adult bulls which do not possess harems are usually found as singles, having little tolerance

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for each other at this season. In winter, extra bulls may sometimes be permitted to join harem groups, but most form into bachelor bands which are isolated from other animals.

Calves are born during April or May when weather may still be severe in arctic regions. Within a few hours they can follow the mother during her normal movement with the herd. Growth is rapid and a calf weighting 20 pounds at birth may reach as much as 200 pounds at one year. The rate of growth gradually declines, but full size is not achieved until the age of five or more years, when bulls may weight 700 pounds and femals about a third less.

Musk oxen have few natural enemies. Polar or grizzly bear may occasionally attack them, but probably are seldom a danger. Wolves are a more significant threat, particularly to lone animals and to calves. Behavior patterns of musk oxen when faced with danger suggest wolves were their chief, natural enemy. When pursuers approach and escape is impossible, musk oxen whirl with military precision and present a veritable array of horns that present some difficulty to an attacking wolf pack. There is a constant shuffling about, as each animal, even calves, attempts to take a position in the front line. Sometimes, in open terrain, the defense formation takes the form of a circle or ring. More frequently, the line forms on the edge of a cliff or against a bank.

At present, other factors are more important causes of mortality than predators or man. Most deaths occur in late winter when shortage of food or other stresses may cause the death of animals which are sick, injured, or perhaps merely old and past their prime. Particularly severe weather conditions, especially deep snow or icing, may cause the loss of large numbers of animals by starvation, and entire herds have been lost in this manner, particularly on islands where the food supply was limited.

Despite the many natural causes of death, adult mortality under normal conditions is low and many animals may live to old age. So few animals have been marked, however, that the single record of longevity is of a female that died in an accident when 23 years old.

Red Wolf Study Inaugurated

One of the most endangered mammals in North America, the red wolf, may have a better chance for survival in the wild through establishment of a cooperative federal-state recovery team. Appointment of the team comes on the heels of reports that the red wolf, which is imperiled by both human persecution and hybridization with the related coyote, is in an even more precarious situation than had been thought. In the early 1970s there were hopes that a last remnant population in extreme southeastern Texas could be stablized and saved from interbreeding with the coyote. Specimens collected in 1974, however, indicate that the hybridization process now has spread even into this population. The recovery team may soon initiate new conservation measures, possibly including evacuation of red wolves from some areas and introduction into others.

The red wolf, the only one of its kind in the world (all other wolves in the world are subspecies of the gray wolf), was one of six endangered species that the U.S. Fish and Wildlife Service selected for priority treatment when it appointed separate recovery teams for each animal recently. The five other endangered animals are: Delmarva fox squirrel, Indiana bat, Kirtland's warbler, dusky seaside sparrow, and the Mississippi sandhill crane.

The red wolf (*Canis rufus*) is a close relative of the gray wolf (*Canis lupus*) and the domestic dog (*Canis familiaris*). Before the coming of European man, the red wolf was found throughout the southeastern quarter of North America, from central Texas to the Atlantic, and from the Gulf Coast north to the Ohio Valley and Pennsylvania. As was the case with other large predatory animals, the red wolf was intensively hunted, trapped, and poisoned by farmers and ranchers because of its threat to domestic livestock. In the early 20th century, after the species had been largely eliminated east of the Mississippi River, federal and state governments joined in the extermination effort. By the early 1970s, when it finally was legally protected, the red wolf was thought to survive only in a narrow strip of coastal marsh and prairie in extreme southeastern Texas and southwestern Louisiana.

Despite human persecution, the red wolf might have been able to survive in a few remote areas had it not been for the critical hybridization problem. Prior to the impact of modern man, the range of the red wolf was largely separate from that of its western relative, the coyote (*Canis latrans*). When settlers cleared forests and killed off red wolves, they inadvertently opened the way for the coyote to extend its range eastward. As the small, adaptable coyote moved in, some interbreeding occurred between it and surviving red wolves. These initial crosses set in motion a massive process of hybridization which eventually spread throughout much of the former range of the red wolf.

The presence of coyotes and hybrids led many persons to think that the red wolf still survived. Examination of many old and new specimens, however, has enabled biologists to trace the decline of the true red wolf across the continent. Before 1920, hybridization was largely restricted to central Texas. In the 1930s and 1940s the same phenomenon engulfed Arkansas, eastern Oklahoma, and southern Missouri. By the 1960s, much of eastern Texas and Louisiana had also been taken over by coyotes and hybrids, and it appeared that the red wolf survived only to the south and east of Houston in Texas, and in parts of southern Louisiana. By 1970, the only known pure red wolf population was found in Jefferson and eastern Chambers Counties, Texas, but now this population is in immediate jeopardy.

Hard-pressed federal agents in southeast Texas have for several years been attempting to slow the tide of interbreeding by trapping coyotes and hybrids on and near red wolf range. These men also have been live-capturing stock-killing red wolves in order to moderate ill feelings by local stockmen, as well as to establish a captive breeding pool. The new recovery team may continue these and other conservation operations, and also will try to develop new methods. Some authorities have suggested a large-scale live-capture and reintroduction effort in which some of the last pure red wolves would be removed from southeast Texas and released on certain offshore islands or in other suitable areas far from the range of the coyote.

Coyotes and Sheep: New Data

A Montana study is providing additional information on the old and sometimes heated controversy related to coyote-sheep relationships, according to the Wildlife Management Institute. Data collected from the study indicated that the coyote can inflict sigificant damage to unprotected domestic sheep herds.

The study was initiated by the University of Montana on an 8,500-acre ranch in the Bitterroot Valley south of Missoula. Funded by the U.S. Fish and Wildlife Service, the investigation was designed to record all sheep losses, both by predators and from natural mortality.

From March to October 1974, no controls were placed on the coyotes. The predators were allowed to take as many sheep as they would. However, 61 coyotes were killed on the area shortly before the study began. About 2,000 sheep were exposed to predation during the six-month reporting period. Coyotes killed 429 sheep, 364 of which were lambs. That amounted to about 86 percent of the total sheep deaths. Two sheep were killed by golden eagles, and two by feral dogs. The dogs also wounded 11 more.

Although the predator kills were high, researchers said that lack of control was part of the cause. "What we have shown," the researchers said, "is that coyotes under certain circumstances do kill sheep. . . .People who want to latch onto our study and flaunt it as proof against coyotes are mistaken. We are just printing the results of a baseline study

which had little or no controls placed on the coyotes. We are not using our data to make generalizations on the coyote-sheep problem everywhere."

The researchers said the coyote problem varies from area to area. In some places they are no problem at all—in others they are. There has to be selective control, they added, and new devices are being developed to help.

What Happened to the Blue Pike?

A unique fish, commercially harvested by the ton as recently as the 1950s, has disappeared. Under authority of the Endangered Species Act, a team of experts is trying to learn where the blue pike went and what might be done to bring it back—if it ever existed at all biologically.

The mysterious blue pike resembles the well-known walleye in all respects except its smaller size and bluish, instead of yellowish, coloring. It once filled the trap nets of commercial fishermen in Lake Erie's eastern basin, where blues were often caught in the same net hauls as walleyes. Oldtimers recall boats docking in Erie's eastern ports with tons of blue pike heaped on board.

Then, some unexpected change in Lake Erie's environment or some other unknown factor caused a sudden crash in blue pike populations. In recent years, although sport fishermen have occasionally reported catching blue pike, not one of these reports has been verified. In fact, some authorities feel that verification is impossible, that the blue pike is nothing more than an unusual color phase of the walleye.

So the first mission of the blue pike recovery team is to prove that the fish exists. To do this, they may offer a reward for the live capture of the fish so that "true blues" can be bred in captivity to prove their genetic identity. If attempts to find and propagate blue pike are successful, an attempt may be made to reintroduce them to selected parts of their original range.

Captive Whoopers Lay First Eggs

Two eggs were laid in late April by captive whooping cranes at the Patuxent (Maryland) Wildlife Research Center, a facility of the U.S. Fish and Wildlife SErvice. The two layings —ten days apart—are the first known layings by this species while in captivity. Government biologists described the layings as "major events of scientific importance."

Because the eggshells are too thick to candle, it is not known if either egg is viable. Whooping crane eggs require about one month to hatch; meanwhile, they are being artificially incubated.

The parent birds were hatched from eggs taken from the nest of wild whoopers in northern Canada in 1968. The captive flock was established at the Patuxent center in hopes of restoring wild populations. Only 49 of the species were counted in the wild during the 1974-75 annual winter census.

Elsewhere, in early April, several whoopers were exposed to a commonly fatal disease while en route to their northern nesting grounds. Nine of the birds were forced to earth at the Sacramento-Wilcox Game Refuge, in Nebraska, by a sleet storm. Their arrival coincided with an epidemic of avian cholera that killed at least 15,000 waterfowl at the refuge. It was unknown whether the whoopers caught the disease, since the birds remained in the area for only 36 hours. The incubation period for avian cholera is 24 to 48 hours. From shortly after the birds' arrival, a crew of state and federal game officers went about the area trying to chase them away.

"This is the first anyone can remember them coming through this area," remarked one of the officers. "Who would have believed the biggest bunch ever would have picked such a little spot, the worst spot, of all the places to land?"

Aerial surveys of the crane's nesting grounds in Canada showed that fifteen chicks hatched last summer. But only two immature birds were seen among the forty-nine whoopers counted in early December at Aransas National Wildlife Refuge in Texas. That is an increase of one bird over the 1973-74 count, but still far below the record fifty-nine reported from Aransas in 1971. Biologists, meanwhile, are puzzled over the poor survival rate of nestlings.

These Animals Have Come Back!

The media have given substantial attention in recent years to the plight of animal species threatened with extinction, pointing out that man must mend his ways if they are to survive. We hear little about those that have survived just such a crisis. As recently pointed out by the Wildlife Management Institute, however, a number of species have made remarkable comebacks—thanks to human endeavor—since the turn of the century. Some outstanding examples are the following:

- Beaver: *1900*—Eliminated from the Mississippi Valley states and all eastern states except Maine; common only in Alaska and a few localities in the Pacific Northwest and Rockies. *Today:* Common to abundant in nearly all states except Hawaii.

- Pronghorn antelope: *1925*—Authorities estimated 13,000 to 26,000 in U.S.A., most in Wyoming and Montana. *Today:* Minimum population in all western states is 500,000.

- Bison: *1895*—800 survivors. *Today:* Population more than 35,000 in North America.

- Elk: *1907*—Common only in and around Yellowstone National Park; estimated total south of Canada, 41,000. *Today:* About 1 million in 16 states.

- White-tailed deer: *1895*—About 350,000 south of Canada; extirpated from more than half the states. *Today:* Approximately 12 million in 48 states.

- Wild Turkey: *1930*—Common in only a few southern states, eliminated from most. *Today:* Restored to 43 states, including establishment in several outside original range of species.

- Fur seal: *1911*—Official census in Pribilof Island showed 215,900. *Today:* Herd maintained at around 1.5 million under a scientific management program.

- Egrets and herons: *1920*—Several species on the brink of extinction because of slaughter on their nesting grounds by feather collectors to supply the millinery trade. *Today:* Most species common to abundant over most of the United States.

- Trumpeter swan: *1935*—73 survivors south of Canada on one wildlife refuge. *Today:* Thriving populations on two national parks and several national wildlife refuges. Removed from the endangered status in the late 1960s.

- Wood duck: *1915*—Greatly reduced in numbers and considered a candidate for early extinction. *Today:* The most common breeding waterfowl in eastern U.S.A.

- Sea otter: *1907*—Nearly extinct; a few survivors in Alaska's Aleutian chain and in coastal California. *Today:* Minimum of 50,000; successfully restored to waters of mainland Alaska, Oregon, Washington, and British Columbia, increasing and extending range in California.

In Sapporo, Japan, eight persons successfully sued for damages when their sunlight was cut off by the erection of an eleven-story apartment building.

A geologist reports that the recent collapse of a number of castles and other ancient monuments in Sweden was caused by detergents that turned supporting clay to mud.

field briefs

E. Leland Webber

Director E. Leland Webber Celebrates 25th Year

June 1 is the anniversary of E. Leland Webber's 25th year with Field Museum. Since 1962 he has been this Museum's director. He is also one of its greatest assets: warm spokesman for the Museum, effective fund-raiser and staff-builder, dynamic human who has strengthened the Museum's position as one of the leading natural history museums in the world.

Have you met him? If not, introduce yourself at the next membership function. He does have a special affection for his Museum's members; you'll know it the moment you shake hands.

Record Crowds for Members' Nights

Members' Nights, May 1 and 2, attracted record-breaking crowds, with a total of 15,551 members and guests for the two evenings. The previous high attendance for members' nights was 12,092, in 1974.

Coinciding with Thursday's open house, on May 1, was the long-awaited full restoration of the north steps for daily public use. For more than a year, repair and waterproofing work had continued on the steps as part of the Museum's $25 million rehabilitation program. Similar work at the Museum's south entrance was completed several months ago.

Walter F. Kean Succumbs

The Museum was grieved to learn of the sudden death of Walter F. Kean on February 24, 1975, in his home near Santa Fe, New Mexico. Walt was a retired electronics engineer, and a former resident of Riverside, Illinois. It was back in 1964 that he became associated with the Museum, cutting and faceting numerous gemstones from the rough gem specimens that had been acquired over the decades in the Museum collections.

Walt did not begin active interest in gem-cutting until 1960. Being an engineer, he looked critically at the available gem-cutting equipment on the market at the time, found it wanting in the kind of precision he demanded, and decided to design his own. After four different designs he finally came up with a faceting machine that was precise enough to satisfy his standards. The results were spectacular—stones that were brilliantly polished in precise geometrical forms.

Walt was never happy to simply facet a stone according to some standard design. He studied each stone, looked up its optical and physical properties, and designed the geometry of the facets to take best advantage of the particular piece in hand. To him it was both art and science. The gemological community in the United States was not indifferent to this kind of approach. In 1963 he received prize trophies in a Chicago-area competition, and repeated this performance in 1964. In 1965 he won five awards in competition that covered entries from the whole midwestern region. The culmination came in 1967 when he won the national trophy for gem-faceting in the master's class. After that, Walt stopped entering competitions, but he continued to lecture widely on all aspects of faceting.

After his retirement he became active in lapidary circles in the Santa Fe and Los Alamos areas, and continued to facet stones for the Museum. Over the years he did such a thorough job of faceting rough gem specimens from the Museum's collections that we have literally run out of rough stones of the quality that are worthy of faceting. Numerous examples of Walt's work can be seen on exhibit in the Higinbotham Hall of Gems. On the label of each piece he faceted for us is printed, "Faceted by Walter F. Kean."

Over the decade that Walt was an Associate in Mineralogy in the Department of Geology he performed a service the Museum could not obtain any other way. Commercial gem-faceting companies cannot economically handle the larger and exotic gem specimens that are the standards for museum exhibition. It was only through the voluntary services of a person like Walt Kean that we were able to add these superbly cut stones to our gem exhibit. He will be missed by the Museum, and especially by the staff members who knew him personally.

Walter F. Kean

Art in Ancient Ecuador and Modern Africa

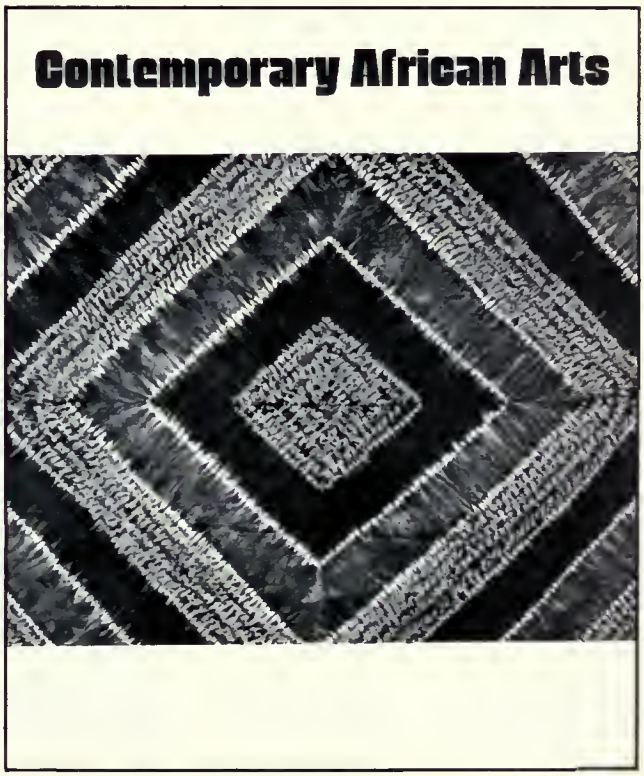
Mail orders for the catalogs should be addressed to the Field Museum Book Shop. Museum members receive a 10-percent discount.

Two handsome catalogs, featuring artifacts displayed in two major exhibitions at Field Museum, are now available at the Museum bookstore. *Ancient Ecuador: Culture, Clay, and Creativity 3000-300 B.C.* is a 110-page, 9x12-inch catalog with photos and detailed descriptions of each of the 604 artifacts on view at the exhibition, which continues in Hall 9 until August 5. The entire text and catalog sections are bilingual—in Spanish and English. The text is by Donald W. Lathrap, professor of anthropology at the University of Illinois, Urbana; the catalog is jointly written by Donald Collier, Field Museum's curator of Middle and South American archaeology and ethnology, and by Helen Chandra, of the Museum's Department of Exhibition. Price of the catalog is $5.95.

The pottery featured is the earliest known from North or South America and represents a level of culture known as the Formative stage. In Ecuador this stage began prior to 3000 B.C.—a millenium before the Formative in Peru or Mexico. The text of the catalog has chapters on the appearance and the economy of the stage, the ceramics of the period, the figurine tradition, life in Formative Ecuador, and influence of the Formative on the emerging civilizations of Mesoamerica and Peru. Six full-color plates accompany the text.

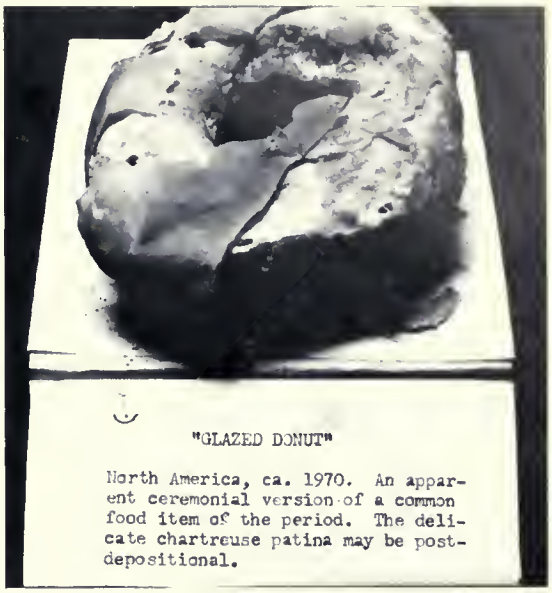
Contemporary African Arts, ($5.00) by Maude Wahlman, who was recently consultant in African ethnology at Field Museum, was published in conjunction with the contemporary African arts exhibition, on view at the Museum in 1974. The 124-page catalog features essays on the various art forms of contemporary Africa. Separately covered in 13 chapters are pattern-dyed textiles, woven textiles, pottery, calabash carving, sculpture, counter-repoussé panels, graphics and painting, leatherwork, architecture, beadwork, music, dance, literature, and the film. An extensive bibliography, twelve color plates and 120 black-and-white photos supplement the text.

The wealth of text material sets this book apart as much more than just a catalog. It is quite possibly the most comprehensive work on the arts of contemporary Africa now available.



unnatural history

Among field Museum's rare artifacts not on public view is the curious relic, at right, vintage ca. 1970 and identified as a glazed donut by the eminent gastroethnologist A. Cruller-Dunquer. The location of the priceless object, notable for its crudiform patina, is known to only a few of the Museum's anthropology staff. The artifact is even more unusual within its genre for the astonishing planarity of the upper right quadrant—almost as though it had tumbled willy-nilly into a microtome and been partially sectioned like some hapless chunk of salami. Characteristic of this vintage is the aesthetically delightful central depression, the fossa bronsonus *(bronsonian fossa). Pieces lacking this oldenburgian feature are commonly described by berlinologists as* bonapartean *(rarely* napoleon*). Provenience unknown. Catalog number pending description in the technical literature.*



"GLAZED DONUT"

North America, ca. 1970. An apparent ceremonial version of a common food item of the period. The delicate chartreuse patina may be post-depositional.

Through History with The Gobboon

1: Julius Caesar. *De Bello Gallico*, Book vi.

Having thrown[1] a bridge across the river, Vercingetorix came into the Province of Sanctimonium to yield his armies to Caesar. . . . That evening, Vercingetorix built[2] a party for Caesar and served xlvii roast gobboons[3].

1. *Ponte trans flumen iactato* (abl. abs.). Almost certainly, Vercingetorix *built* or *constructed* that bridge; he lacked the technology to *throw* it.
2. *Convivium fecit in honorem Caesaris.* Almost certainly, Vercingetorix *threw* that party; one doesn't *build* or *make* parties.
3. *Gobunos* (acc. pl., masc.)

2: Caius Plinius Iocundus. *Historia Naturalis*, Book v.

The animal of southern Europe most similar to the gobboon is the wartwolf of Tuscania[1]. But the gobboon is much smaller, with a strikingly different head and postcranial anatomy. . . .[2] The true gobboon of the German woodlands bears a tridentate barb on its tail, with which it spears elvers.

1. The last wartwolf was killed by Leonardo the Scruffy, son of Leonardo the Unclean, in 1567. Neither of the Leonardos ever even saw a gobboon.
2. Omission of four sentences of balderdash.

3: Adam Bede. *Historia Universalis sive libri x de Vitibus Sanctorum Germanorum*, Book iv.

The men who dwell in these woods catch the gobboon[1], which they roast[2] by wrapping the freshly killed animal in an eagle's nest and burying it beneath the coals of a ceremonial fire. The flesh of the gobboon is garnished with acorns, and the hide is used for shields and for the soles of their boots. It's not necessary to hobnail the soles[3], for the hide is tough and hard.

1. *Gobbunam* (acc. sing., fem.). The change of gender and the doubling of the *b* simply show that the *editio princeps* of Bede was based upon a corrupt text.
2. *Roast* is only an approximation for this process. Bede has *immolant.*
3. *Solos cothornostibere necesse non est.* Bede has latinized a rare Late Hellenic verb, κοθορνοστιβειν.

4: Saint Gildas. *Annales Sanctorum hibernicorum*, Book iii.

Padraic well knew that the **gobbüner** of northern Westphalia would hunt down and destroy any snakes[1] they could find. So he bought thirty of these animals and took them with him to Hibernia in his coracle[2]. . . . King Brian Boru maintained a herd of more than a hundred ghaughbbhughns[3] under the care of his Keeper of the Mistletoe.

1. The original MS, in the library of Trinity College, is in shorthand; the reading *snakes* could equally well be *snares*. Padraic had a horror of snares, and soon after he landed on Hibernia he issued orders for the elimination of snaring. There is, of course, no record of a gobboon having ever been ensnared—anywhere.
2. The size of Padraic's coracle has not been fully appreciated. Even 30 lemmings would swamp the average coracle.
3. The proper Gaelic spelling (not *ghaubbbhughn*)

5: Wulfstan of Cork. *Plethora Historiarum*, Book ii.

It pleased the master builder to design new and strange capitals for the columns of the transept, and on them may still be seen the simulacra of the animals of the nearby forest: capricorns and loaches and gobboons and herissons.

A fossil Gobboon bone from Thomas Jefferson's collection, Philadelphia

The gobboon, supposed to be extinct, has received little notice in modern bestiaries. The few extracts above represent about all that is known on the subject. Since the works quoted are readily available in any village library, only the briefest extracts are given. And, in order not to detract from the forthcoming eagerly awaited monograph by R. L. Ulrich, only the barest minimum of learned footnotes has been included.

"Through History with The Gobboon" (slightly reduced here in size) is said to be from a rare volume on natural history, of which no complete copies are known. Since all extant copies lack the title page and colophon, it is impossible to cite the reference. This work was brought to our attention by The Vanishing Press, operated as an avocation by Eugene S. Richardson, curator of fossil invertebrates.

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JUNE and JULY at Field Museum

EXHIBITS

Continuing

Ancient Ecuador: Culture, Clay and Creativity, a special bilingual exhibition continues through August 5. The exhibition includes some 600 objects dating from 3000-300 B.C., and reveals a civilization at least 1,000 years older than any previously known in the Western Hemisphere. All display labels, as well as a lavishly illustrated catalogue, are in Spanish and English. Hall 9.

Field Museum's Anniversary Exhibit continues indefinitely. "A Sense of Wonder" offers thought-provoking prose and poetry associated with the physical, biological, and cultural aspects of nature; "A Sense of History" presents a graphic portrayal of the Museum's past; and "A Sense of Discovery" shows examples of research conducted by Museum scientists. Hall 3.

SPECIAL PROGRAMS

Continuing

Craft Demonstrations and Discussions

"African Patterns," 10:00 a.m. to 12:30 p.m., Mondays, Wednesdays, and Fridays. Entrance to Hall 27.

"The Ways of Our Ancestors: Traditions of Native North America." 10:00 a.m. to 12:00 noon and 2:00 to 5:00 p.m., Fridays. Hall 4.

Saturday Discovery Programs

A series of tours, demonstrations, and participatory activities offered continuously from 11:00 a.m. to 3:00 p.m., include Ancient Egypt, Prehistoric Man, Reptiles, Northwest Coast Art, and The World of Animals. For details, inquire at Museum entrances.

CHILDREN'S PROGRAMS

Begins June 1:

Summer Journey for Children, "All Time Favorites," a free, self-guided tour focusing on Museum exhibits. All boys and girls who can read and write are invited to participate. Journey sheets in English and Spanish are available at the Information booth.

MEETINGS

June 3, 7:30 p.m. **Kennicott Club**
June 8, 2:00 p.m. **Chicago Shell Club**
June 10, 7:00 p.m. **Nature Camera Club of Chicago**
June 11, 7:00 p.m. **Chicago Ornithological Society**
7:30 p.m. **Windy City Grotto, National Speleological Society**
June 12, 8:00 p.m. **Chicago Mountaineering Club**
June 20, 7:30 p.m. **Mid-West Russian Blue Association**

COMING IN JULY

"African Patterns" continues. Entrance to Hall 27.

Anniversary Exhibit continues.

Ancient Ecuador: Culture, Clay and Creativity exhibit continues.

Summer Journey for Children, "All-Time Favorites" continues.

MUSEUM HOURS

The Museum opens daily at 9:00 a.m. and closes at 6:00 p.m. Saturday through Thursday, and 9:00 p.m. Fridays. From June 21 through Labor Day the Museum remains open until 9:00 p.m. Wednesday, Friday, Saturday, and Sunday.

The Museum Library is open 9:00 a.m. to 4:00 p.m. Monday through Friday. Please obtain pass at reception desk, first floor north.

Museum telephone: 922-9410

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Field Museum of Natural History Bulletin

Field Museum of Natural History Bulletin

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Woodland pond, photo by Charles F. Davis, of Oak Park, Ill. Mr. Davis recently taught a nature photography course at Field Museum. Reproduced in 300-line photolithography by Parkway of Batavia, Ill.

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Using long-handled tongs, Harold Voris separates highly venomous sea snakes from catch of fish and prawns.

Sea Snakes: A Field Report

by Harold and Helen Voris

Well over fifty years ago, in 1917, Malcolm Smith made the world's first extensive collection of sea snakes, for the British Museum. This spring, in Kuala Kurau, Perak, Malaysia, we met an elderly Malay fisherman who had collected snakes for Smith. Smith's collections and monographs have stood for many years as the major work on sea snakes; but soon Field Museum will have an even larger sea snake collection as one result of a year-long study in the Straits of Malacca and the South China Sea. The work is supported in part by the Allen-Heath Foundation and the Philip K. Wrigley Marine Biological Research Fund.

The sea snakes are a family of about fifty species of marine and estuarian snakes; they are related to the cobras and coral snakes but are even more venomous. All true sea snakes have flattened, oarlike tails, and most have nostrils positioned—like those of crocodiles—on the top of the head. By far the greatest number of species occurs in the tropical areas of South East Asia; as many as seventeen species may be found in our main study area, the Straits of Malacca, which lie between the Malay Peninsula and Sumatra.

Although a large general collection of sea snakes is of value to the Museum, it is only one product of the research we have under way here. The main focus of our work is on the ecology of these highly specialized marine creatures. So far, our observations indicate that the seventeen or so species of sea snakes occurring in the straits are not all distributed throughout the straits, but form unique assemblages of only six or seven species at each of our collecting sites. In view of this, we are trying to find out who lives with whom, and where and why. How do these species which live in the same area divvy up the resources such as food and

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Harold Voris is assistant curator of reptiles and amphibians.

space? To help answer these questions we are looking at what each species eats by examining their stomach contents. We have found some species to be generalists, eating a large variety of fish and cuttlefish. Others are specialists, concentrating exclusively on fish eggs or eels, for example. We are also looking at reproduction patterns—Do all the different species at a locality give birth to their young at one time? Is there synchrony within a single species at two separate localities? If so, what environmental cues are used in these habitats that lie directly on the equator?

We obtain our collections of sea snakes by working with the local fishermen who regularly catch and release them in the course of their normal fishing activities. At two localities, Sungai Buloh and Parit Botak, trawling is the predominant fishing method. We go out with the trawlers collecting data—as well as snakes— on salinity, turbidity, bottom type, and water depth, in order to try to characterize the habitat in which each species of snake lives. At Muar, our third major collecting site on the straits, we are working with fishermen who use the river stake net, or *pukit togok*.

The *togok* net is suspended from a bamboo stake frame permanently planted in the mud at the mouth of the river. As

(Continued on p. 21)

Top: Local fisherman lowers togok net as tide begins to run out. Bottom: Downstream from a raised togok net at Muar.

FIELD MUSEUM'S AGUSAN GOLD IMAGE

"The most spectacular find yet made in Philippine archeology"

by Bennet Bronson

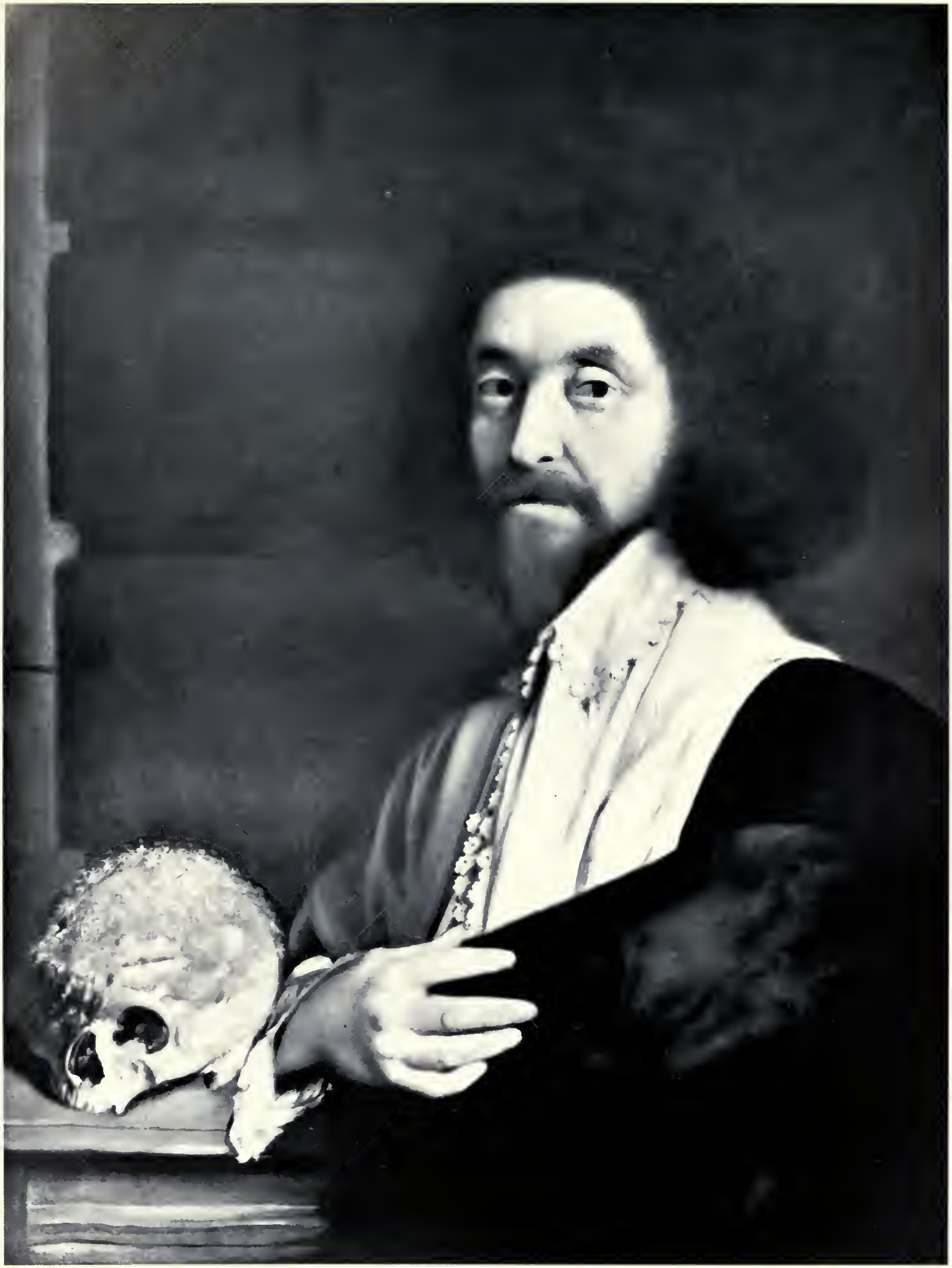
Displayed in a wall case in the Museum's Hall of Gems is a small statue of solid gold, roughly but boldly cast, in the form of a seated and haloed woman. While easy to overlook, it is a famous piece. In the words of H. Otley Beyer, for decades the dean of archeologists in the Philippines, this statue is "the most spectacular single find yet made in Philippine archeology."

It is said to have been found in 1917 by an anonymous woman, probably of the Manobo tribe, while walking through a little-frequented ravine in Agusan Province in the southern Philippines. After a series of narrow escapes from the gold dealer's melting pot, the statue chanced to come to Beyer's attention. Immediately recognizing its importance, he tried unsuccessfully to persuade the (American) colonial government to purchase it for the National Museum in Manila and then turned for help to three private individuals: Faye-Cooper Cole, then Southeast Asian curator at this museum; Shaler Matthews, professor of religion at the University of Chicago; and Mrs. Leonard Wood, wife of the governor-general of the Philippines. Through the efforts of these three the money was raised. The statue arrived, still in good condition, at Field Museum in 1922.

The statue is five and a half inches high and weighs almost four pounds—a substantial quantity of gold. However, its historical importance greatly exceeds its value as bullion, for it symbolizes the start of a major era in Philippines history. Before the statue was made, about A.D. 1000-1300, the Philippines were isolated from the mainstream of world events. Other parts of Southeast Asia had been closer to the developed parts of Eurasia and Africa and had begun to show the effects of this contact—the use of writing, of imported art styles, and of outside political and religious ideas—as early as A.D. 100. In the Philippines, on the other hand, this process of "Asianization" began so late that some have doubted that it occurred at all, maintaining that the islands remained effectively isolated until the arrival of Muslim traders and Spanish conquerors in the early 1500s. Yet, evidence is now accumulating to the contrary. Vast quantities of Chinese and Thai ceramics are being found, showing that the Philippines were commercially linked to the rest of the world by A.D. 1000 at the latest. Specialists are begining to take new interest in the fact that many Philippines people possessed the art of writing long before the arrival of the Conquistadors, apparently borrowed from India at an early date. And occasional objects are discovered which show that the ancient Filipinos were not passive spectators of the contact process. The Agusan Gold Image is prime evidence of this.

What else the image is remains a puzzle. It is clearly a Hindu or Buddhist female deity: according to the Filipino expert Juan Francisco, perhaps a *sakti* or a *tara*. But it is quite atypical by the standards of most Hindu-Buddhist artistic traditions including that of ancient Java, to which it seems distantly to belong. Perhaps, as Otley Beyer himself suggested, the statue was made in the Philippines by Javanese miners, not necessarily expert in their own artistic traditions, while engaged in working the placer gold deposits in the Agusan area. Or perhaps, as the great Dutch historian F. D. K. Bosch once hinted, the statue is atypical in style because it was made by native Filipinos. Like other Filipinos, the Manobos of Agusan have a long tradition of excellent metal-working, as is shown by several of the exhibits in Hall G at Field Museum. A Manobo artist in, say, A.D. 1100 might have been quite capable of producing the statue. However, no such speculation can be proved at present. We will not know definitely who made it until many more Philippines excavations have been performed. □

Bennet Bronson is assistant curator, Asiatic archaeology and ethnology.



John Tradescant the Younger. Painting attributed to Emanuel de Critz; 31 x 23 inches. National Portrait Gallery, London.

"Musaeum Tradescantianum" a rare gift to field museum

by W. Peyton Fawcett

Christopher Legge, custodian of collections in the Department of Anthropology (retired), recently returned from a visit to England. He immediately came to me with the news that he had a gift from Mrs. Fuller that he had been reluctant to trust to the mails and had hand-carried across the Atlantic. As Field Museum librarian, one of my duties is to receive and record the many books and other materials that are donated to the library. It is always a pleasure to receive these gifts and a special one if the works are historically interesting or rarely encountered. When Mr. Legge mentioned the name of Mrs. Estelle W. Fuller I knew that I was about to receive a most interesting work; for she has given numerous rare volumes to the library over the years. I was not disappointed!

Mr. Legge handed me a small, leather-bound volume published in London in 1656, bearing the title: *Musaeum Tradescantianum: or, A Collection of Rarities. Preserved at South-Lambeth near London* by John Tradescant. It is a list of the contents of the museum known popularly as "Tradescant's Ark" and of the plant species growing in the attached garden. The museum was founded by John Tradescant the elder and continued by his son John, who is the author of the catalog. Both men were noted travelers, collectors, and gardeners and their museum contained the natural history specimens, anthropological and archeological objects, specimens of industrial art, coins, and curios that they had amassed as a result of their travels and passion for collecting, and as gifts from their friends. The collection included such diverse items as the "Dodar (dodo), from the Island Mauritius; it is not able to flie being so big." "A Cherry-stone, upon one side S. Geo: (St. George) and the Dragon, perfectly cut: and on the other side 88 Emperours faces," "Anne of Bullens (Anne Boleyn's) silke knit-gloves," and "Shooes to walk on Snow without sinking."

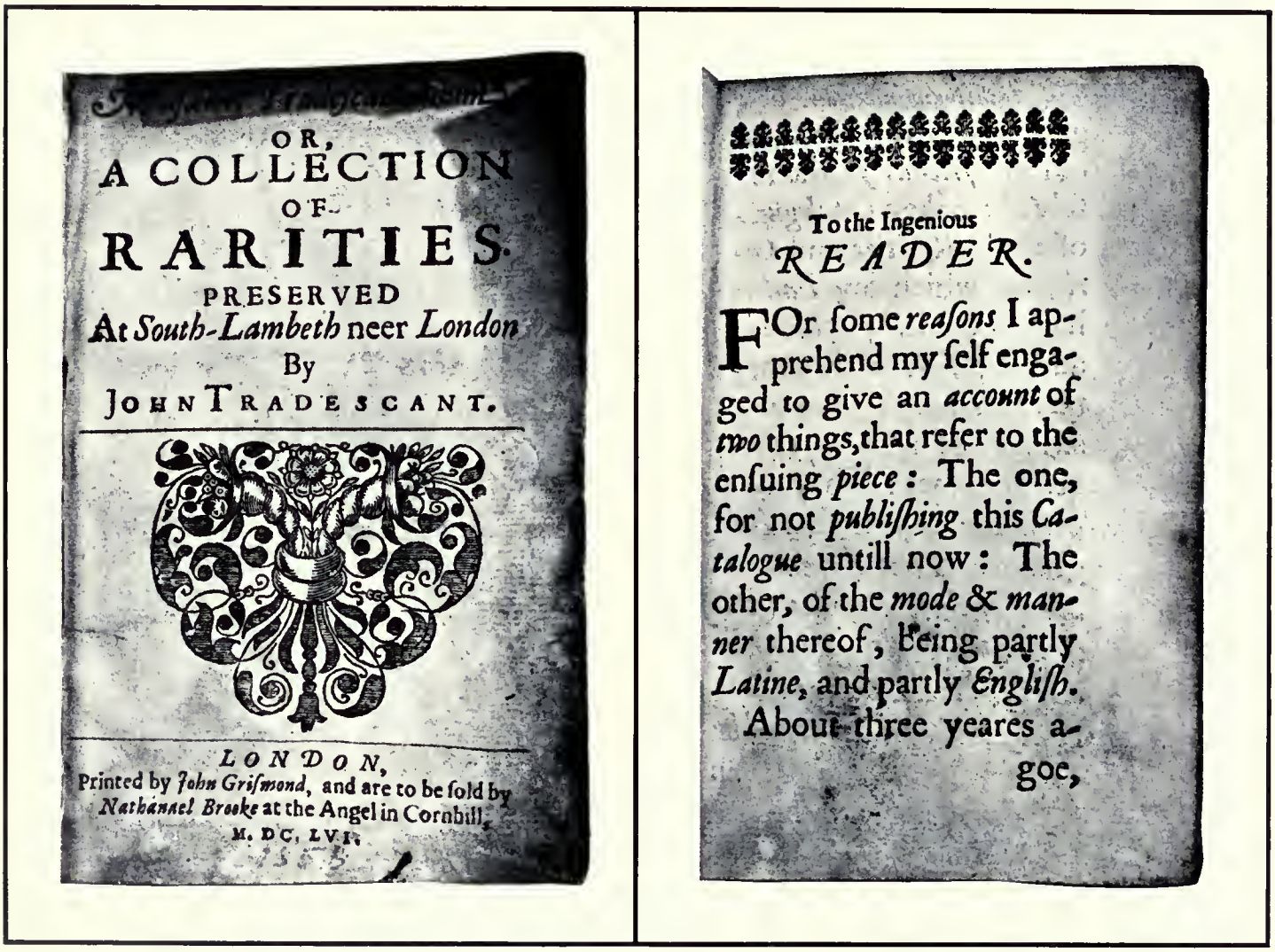
The attached garden contained exotic

Engraving of John Tradescant the Younger. Artist unknown.

W. Peyton Fawcett is Field Museum librarian.

plants from all over the world. The Tradescants collected plants with the same avidity as they did curios and are credited with introducing many into England, including the lilac and acacia. The Ark was a great attraction in its day and no visit to London was considered complete without a view of "John Tradeskin's rarities." After the death of the younger Tradescant in 1662 the contents were acquired by Elias Ashmole and incorporated into his own collection. The whole passed by gift to Oxford University in 1682 and was the foundation of the great Ashmolean Museum. Some of the rarities can still be seen there, including the cloak of Pocahantas' father, described as: "Pohatan, King of Virginia's habit all embroidered with shells, or Roanoke."

Below: *Title page of* Musaeum Tradescantianum *and opening page of introductory essay. Complete text of introduction is given on p. 9 (opposite).*



OR,
A COLLECTION
OF
RARITIES.
PRESERVED
At *South-Lambeth* neer *London*
By
JOHN TRADESCANT.

LONDON,
Printed by *John Grismond*, and are to be sold by *Nathaniel Brooke* at the Angel in Cornhill,
M. DC. LVI.

To the Ingenious
READER.

FOr some *reasons* I apprehend my self engaged to give an *account* of *two* things, that refer to the ensuing *piece*: The one, for not *publishing* this *Catalogue* untill now: The other, of the *mode* & *manner* thereof, being partly *Latine*, and partly *English*. About three yeares agoe,

To the Ingenious *Reader.*

For some reasons I apprehend my self engaged to give an *account* of *two* things, that refer to the ensuing *piece:* The one, for not *publishing* this *Catalogue* until now: The other, of the *mode* & manner thereof, being partly *Latine,* and partly *English.*

About three yeares agoe, (by the perswasion of some *friends*) I was resolved to take a *Catalogue* of those *Rarities* and *Curiosities* which my Father had scedulously *collected,* and my *selfe* with continued diligence have *augmented,* & hitherto *preserved* together: They then pressed me with that Argument, *That the enumeration of these Rarities, (being more for variety than any one place known in* Europe *could afford) would be an honour to our Nation, and a benefit to such ingenious persons as would become further enquirers into the varions modes of Natures admirable workes, and the curious Imitators thereof:* I readily yielded to the *thing* so urged, and with the assistance of two worthy *friends* (well acquainted with my design,) we then began it, and many *examinations* of the *materialls* themselves, & their *agreements* with severall Authors *compared,* a *Draught* was made, whith they gave into my hands to examine over. Presently thereupon my *onely Sonne dyed,* one of *my Friends* fell very *sick* for about *a yeare,* and my *other Friend* by unhappy *Law-suits* much disturbed. Upon these accidents that *first Draught* lay neglected in *my* hands another year. Afterwards my said Friends call again upon me, and the desigue of *Printing,* a-new *contrived,* onely the prefixed *Pictures* were not ready, and I found my kinde friend Mr *Hollar* then engaged for about tenne Moneths, for whose hand to finish the *Plates,* I was necessarily constrained to stay untill this time.

Now for the *materialls* themselves I reduce them unto two sorts; one *Naturall,* of which some are more familiarly known & named amongst us, as divers sorts of Birds, foure-footed Beasts and Fishes, to whom I have given usual *English* names. Others are lesse familiar, and as yet unfitted with apt English termes, as the shell-Creatures, Insects, Mineralls, Outlandish-Fruits, and the like, which are part of the *Materia* Medica; (Encroachers upon that faculty, may try how they can crack such shels.) The other sort is *Artificialls,* as Utensills, Householdstuffe, Habits, Instruments of Warre used by severall Nations, rare curiosities of Art, &c. These are also expressed in *English,* (saving the Coynes, which would vary but little if Translated) for the ready satisfying whomsoever may desire a view thereof. The *Catalogue* of my *Garden* I have also added in the Conclusion (and given the names of the *Plants* both in *Latine* and *English*) that nothing may be wanting which at present comes within view, and might be expected from

Your ready friend
John Tradescant

Maria Banyer

MEMOIRS

OF

HENRY OBOOKIAH,

A NATIVE OF OWHYHEE,

AND A MEMBER OF THE

FOREIGN MISSION SCHOOL;

WHO DIED AT

CORNWALL, CONN. FEB. 17, 1818,

AGED 26 YEARS.

NEW-HAVEN:

PUBLISHED AT THE OFFICE OF THE
RELIGIOUS INTELLIGENCER.

1818.

A.

Above: *The Tradescant house, in South Lambeth. The garden is enclosed by wall to right. As a storehouse of exotic plants, animals, and anthropological curiosities, the Tradescant home was one of the first natural history museums.* Left: *Title page of the* Memoirs of Henry Obookiah *(slightly reduced), with facing portrait. Published 1818. Book is among several recently given to Field Museum by Mrs. A.W.F. Fuller.*

(Continued on p. 15)

The Ray A. Kroc Environmental Education Program

for August, September, and October

An overview of the role of natural ecosystems in the economy of life

The Ray A. Kroc Environmental Education Program at Field Museum for August, September, and October, 1975, explores the importance of natural communities from a pragmatic, as well as an aesthetic viewpoint. Man is dependent on a viable biosphere to provide such services as pure air, drinking water, natural resources, and food. Our local native communities have much to show us about these, and other often unrecognized functions performed by natural ecosystems. ➤

Left: *Field Museum diorama of Illinois woodland, Hall 29 (Plant Families)*

Indiana dunes—the unique ecosystem of this region will be the subject of field trips on September 13 and 17.

FAMILY NATURE HIKE

Illinois Beach State Park

Join your children in an exploration of this unique community. Observation will be the theme, and we will hope to see August flowers as well as ants, ant-lions, toad-bugs, damsel flies, and other local wildlife on our way to the Dead River and along its winding banks.

Meet at the site and bring your own lunch and beverage. Detailed instructions will be sent with confirmation. A nonrefundable fee of $2 for adults and $1 for children will hold advance reservation. Priority will be given to parents and their children. Minimum age: 8 years. Limited to 25.

10:00 a.m.
Saturday, August 9

Leader: Betty Deis, Field Museum

ADULT FIELD TRIPS

All adult field trips leave from Field Museum North Parking lot regardless of weather. A non-refundable fee, covers lunch and transportation and holds your reservation. Saturday adult trips are limited to 40 people per trip.

Morton Arboretum Prairie and Wetlands

View a native prairie restoration as a small replica of the once extensive grassland ecosystem, and as a disappearing part of our Illinois heritage. Examine the ecological role of arboretum river and ponds. $5.00 for members. $6.00 for nonmembers.

9:00 a.m.
Saturday, August 30

Leader: Ray Schulenberg, Morton Arboretum

Starved Rock State Park

Enjoy fall color in this beautiful native forest, and discover that trees are more than potential newspapers. $5.00 for members, $6.00 for nonmembers.

8:00 a.m.
Sunday, September 28
Saturday, October 4 (repeat)

Leader: John A. Wagner, Kendall College

Illinois Beach State Park

Learn about the value of marsh and lakeshore and meet some interesting inhabitants of these wetland communities. $5.00 for members, $6.00 for nonmembers.

9:00 a.m.
Wednesday, September 10
Sunday, September 14 (repeat)

Leader: Harry Nelson, Roosevelt University

Indiana Dunes

Hike the dunes and discover how this unique ecosystem is much more than a recreational facility. $5.00 for members, $6.00 for nonmembers.

9:00 a.m.
Saturday, September 13 Wednesday, September 17 (repeat)

Leader: Floyd Swink, Morton Arboretum

COURSE FOR TEACHERS

Introduction to Community Ecology

This course, consisting of four field trips and a museum workshop, will explore communities reflecting both urban and natural ecology. Resource materials, field techniques, and ideas for organizing and conducting school field trips will be presented. A nonrefundable fee, $22.00 for members and $27.00 for nonmembers, holds advance reservation and covers lunch and transportation for field trips. Areas studied include the dunes, a vacant lot, a stream, a prairie, and Lake Michigan.

Two semester hours of graduate credit are offered for this course (listed as #34-581 workshop in Outdoor Education) by the National College of Education. Tuition for credit is $74.00 in addition to the Museum fee, and is payable at the first session. All sessions meet at the North Door of the Museum. Limited to 30. An official degree transcript will be required to receive credit. For further information call Jim Bland, 922-9410, ext. 203.

9:00 a.m.
Saturdays September 13, 20, 27; October 4 and 11.

Leader: Jim Bland, Field Museum

FIELD TRIPS FOR GEOLOGY BUFFS—ADULT

Pit 11

Hunt for fossils and see how an ecosystem of 300 million years ago affects our life in the twentieth century. Bring sack and hammer. $5.00 for members, $6.00 for nonmembers. Meet at Museum North Parking Lot. Limited to 40.

8:30 a.m. Wednesday, October 1 (repeat)
Saturday, September 27 Sunday, October 5 (repeat)

Leader: Eugene Richardson, Field Museum

FIELD TRIPS FOR GEOLOGY BUFFS
12, 13, 14 years old

Pit 11

Take a trip to a strip mine to find fossil evidence of an ancient coal forest. Bring sack and hammer. $5.00 for members, $6.00 for nonmembers. Meet at Museum Information Desk for introductory program. Limited to 30.

9:00 a.m.
Sunday, September 21 Leader: Martha Lussenhop

Reservations for all programs must be made in advance by mail. Confirmations will be sent in order of receipt of coupon on following page (or facsimile) and check. We reserve the right to cancel programs, in which case we will notify you and refund your fee. Otherwise, all fees are nonrefundable.

This program is made possible by the Ray A. Kroc Environmental Fund, which was established at Field Museum by his friends to honor Mr. Kroc, chairman of McDonald's Corporation, on his 70th birthday. Other events of this program will be presented in coming months and years. For further information call Lorain Stephens, Field Museum 922-9410; ext. 360 or 361.

Life-size diorama (Hall 38) of swamp forest as it appeared millions of years ago, when today's coal was still in the form of living plants. Participants in a September 21 field trip will search for fossil evidence of such an ancient forest.

Field Museum—Environmental Program
Roosevelt Road at Lake Shore Drive
Chicago, Illinois 60605

Please enroll me in the following programs at Field Museum:

Program	date	time
Program	date	time
Program	date	time
Program	date	time

Enclosed is my check for $_____, payable to Field Museum.

Name

Address

City State Zip code

Phone: Daytime Evening

Museum Member: Yes_____ No_____

Field Museum—Environmental Program
Roosevelt Road at Lake Shore Drive
Chicago, Illinois 60605

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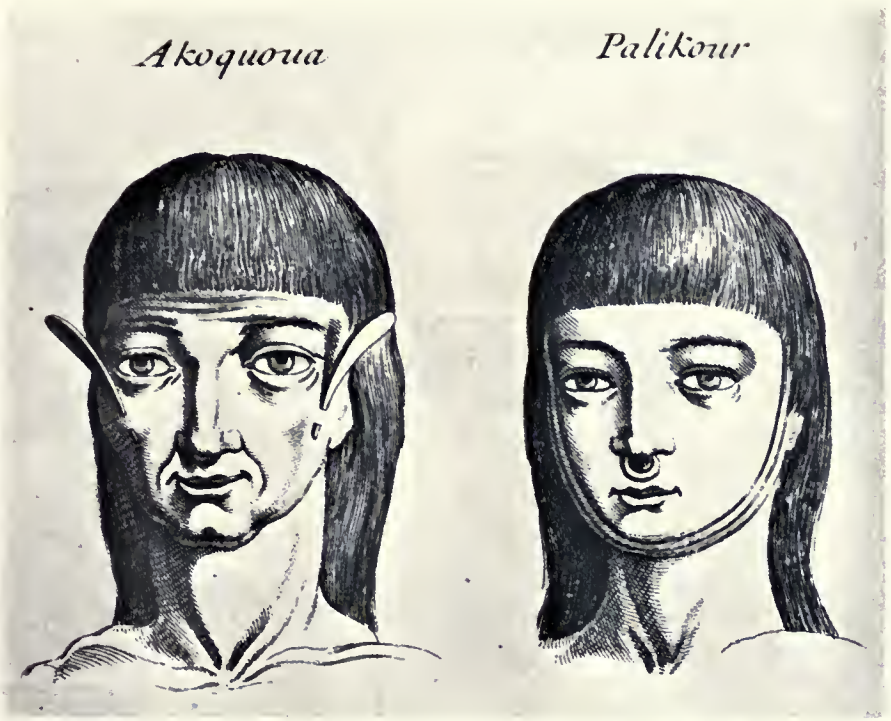
Name

Address

City State Zip code

Phone: Daytime Evening

Museum Member: Yes_____ No_____



Left and below: *Illustrations from* Nouvelle Relation de la France Equinoxiale *(1743), by Pierre Barrère, a French naturalist and physican.*

TRADESCANTIANUM (Con't from p. 10)

Mr. Legge informed me that an additional work—too heavy and cumbersome to be conveniently hand-carried from England—was in the mail to the Museum; and shortly it arrived: *An Album of the Weapons, Tools, Ornaments, Articles of Dress, & of the Natives of the Pacific Islands,* by James Edge-Partington. This valuable work was issued in three series between 1890 and 1898 in a limited edition of 150 copies of the first two series and 175 of the third. It consists of reproductions of pen drawings of the objects together with concise description of each. The plates were lithographed from the author's manuscript. The purpose of the work is to illustrate a great number of types and to assist collectors in identifying their specimens.

Above: *Mrs. A.W.F. Fuller;* right: *the late Capt. A.W.F. Fuller;* facing page: *Clifford C. Gregg, former director of Field Museum, and the late Stanley Field, former president of the Museum, examine artifacts purchased by the Museum from Capt. Fuller in 1958. One of the world's most comprehensive collections of ethnological materials from the South Pacific, it includes more than 6,500 specimens. A great number of these are currently on exhibit in Hall F (Peoples of Polynesia and Micronesia).*

Arriving about the same time as the Edge-Partington was an additional parcel containing three more works: *Nouvelle Relation de la France Equinoxiale,* by Pierre Barrère (Paris, 1743); *Memoirs of Henry Obookiah, a Native of Owhyhee* (Hawaii), *and a Member of the Foreign Mission School; Who Died at Cornwall, Conn. Feb. 17, 1818, Aged 26 Years* (New Haven, 1818); and *Museum Leverianum, Containing Select Specimens from the Museum of the Late Sir Ashton Lever,* by George Shaw, London, 1792.)

The volume by Pierre Barrère, a French naturalist and physician, is a description of French Guiana and contains a great deal of anthropological data. It supplements his *Essai sur l'Histoire Naturelle de la France Equinoxiale* (Paris, 1741) and fills a notable gap in our collection. The "Memoirs" of Henry Obookiah is a curious book that recounts the life and conversion to Christianity of a native of what were then called the Sandwich Islands. It appears to be quite rare. The last of the volumes is part one of a six-part work consisting of colored plates of birds and mammals contained in the Leverian Museum, with descriptive text in Latin and English. The interesting history of the Leverian Museum has been described by Christopher Legge in his article "Tale of a Tiki" (*Field Museum of Natural History Bulletin,* Vol. 38, No. 8; Aug., 1967).

The five works received from Mrs. Fuller are from the library of her late husband, Capt. A. W. F. Fuller, and contain numerous notes in his hand on the provenance, history, and other features of the volumes. The Edge-Partington work, in particular, is a useful supplement to the Fuller Collection of Pacific Artifacts now in the Field Museum. All of the volumes are useful additions to our library and it is a pleasure to thank Mrs. Fuller again for her continuing benefactions. □

our environment

Are These Species Endangered, Threatened, or Safe? Vertebrates, Invertebrates, and Plants Under Consideration

Ten animals—two fish, one reptile, four mammals, and three birds—are being proposed for inclusion on the List of Endangered and Threatened species by the U.S. Fish and Wildlife Service. Acceptance of the proposal would bring the total number of threatened and endangered species in the United States to 119.

The ten animals under consideration for the list include the Mexican wolf, the Cedros Island mule deer, the peninsular pronghorn antelope, the United States population of the American crocodile, the gray bat, the bayou darter, the Scioto madtom, the po'o uli, the Hawaii creeper and Newall's Manx shearwater.

The animals proposed for addition to the endangered list meet at least one of five criteria mandated by the Endangered Species Act of 1973. These criteria are:

- The present or threatened destruction, modification, or curtailment of its habitat or range.
- Overutilization for commercial, sporting, scientific, or educational purposes.
- Disease or predation.
- The inadequacy of existing regulatory mechanisms.
- Other natural or manmade factors affecting its continued existence.

The illustrations on pages 18-21 are from woodcuts executed by Konrad Gesner (1516-1565), a Swiss naturalist and physician. In his time the creatures shown here were believed to actually exist. While some, such as the sea monsters, were based on fragmentary information or imaginative tales, others, such as the butterfly and the white stork (p. 20), are reasonable representations.

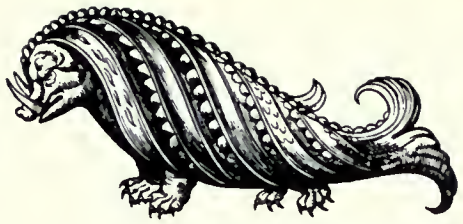
VERTEBRATES...

- *The Mexican wolf* was formerly common in Arizona, New Mexico, southwestern Texas, and much of Mexico. In the 20th century the animal declined substantially in numbers and distribution because of habitat loss and sport hunting. A recent survey of this dark wolf—the smallest in North America—indicated that there are fewer than 200 in Mexico, where they are protected by national law. Enforcement, however, is difficult and many wolves are thought to be killed illegally. These animals exist in widely scattered packs which are subject to intensive human pressure. In the United States, the Mexican wolf now occurs only as a rare wanderer, and there have been few reports of its presence since 1960.

- *The Cedros Island* mule deer is known to exist only on Cedros Island off the western coast of Baja California. Only a few, perhaps less than a dozen, are thought to survive in restricted sections of the island. Although it is illegal to hunt this deer, poaching continues and has been an important factor in the deer's reduced population. Predation by feral dogs is also thought to have been a major factor in the deer's decline.

- *Peninsular pronghorn antelopes* once inhabited most of Baja California, but their range has been greatly reduced, and only two or three small remnant groups survive. Competition with domestic livestock for forage reduced the antelope's numbers. Excessive illegal hunting, some of it by visitors from the United States, also seems to have contributed to this animal's decline.

- *The scioto madtom*, a catfish, lives only in one locality in the lower portion of Big Darby Creek, tributary to the Scioto River, Pickaway County, Ohio. Its habitat is a riffle area with moderate to fast current, where the bottom consists of gravel, sand, silt, and boulders. The scioto madtom has declined because of the pollution and siltation of its habitat. Two proposed impoundments on Big Darby Creek also threaten its limited population.



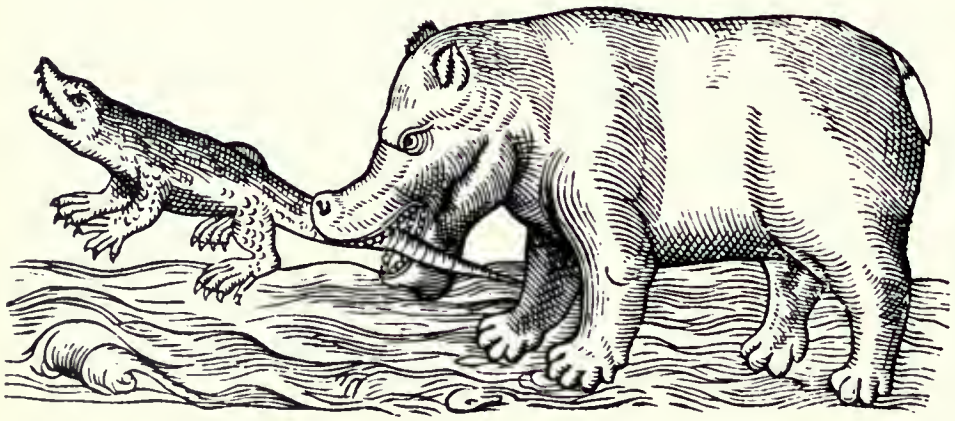
- *The po'o uli*, a sparrow-sized Hawaiian bird with a black mask, was discovered only in 1973. It is restricted to a small area of forest on the northeastern slope of Haleakala Volcano on the island of Maui. The po'o uli, which is Hawaiian for "black-faced," has an unknown history, but its decline was presumably caused in part by habitat alteration and by competition with non-native birds.

- The sparrow-sized *Hawaii creeper* was endemic to the island of Hawaii and was common through the 19th century. Subsequent changes to its native grounds and competition with non-native birds restricted it primarily to a small area of forest between 5,000 and 6,000 feet elevation. The Hawaii creeper's population was also reduced by rat predation and by transmission of avian diseases by an introduced mosquito. The bird is now rare and vulnerable to further environmental disruption.

- *Newell's Manx shearwater* is a medium-sized, black and white seabird that once bred on all of the main Hawaiian Islands. Now its breeding activity is restricted to an isolated part of Kauai. This fish- and squid-eating bird is thought to have been exterminated from most of its range by the introduction of predatory mongooses, dogs, pigs, and rats. The bird's attraction to lights also increases its mortality as it is killed from collisions with cars and lighted towers. Nonetheless, it is thought to number in the low thousands, and does not appear to be in immediate danger of extinction.

- *The gray bat* is quite vulnerable and in danger of extinction, although several large colonies still exist. Large numbers of the bats are needed to maintain a minimum breeding population.

The gray bat uses certain kinds of caves in southeastern and south-central United States for roosting, breeding, and hibernating

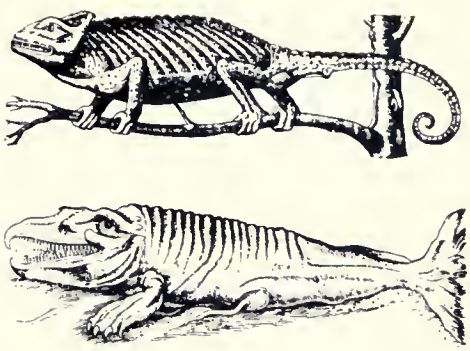


activities. Perhaps no other bat is more dependent upon caves for its existence, and it is the only bat in the eastern United States that normally requires caves in summer as well as in winter. Moreover, this species apparently can only use caves with specific temperature levels. Wintering caves are in short supply; approximately 65 percent of the entire known population hibernates in a single cave, and about 90 to 95 percent of the entire population is restricted to only five caves.

Over the past 20 years at least five other major wintering caves have been destroyed. Several major groups of bats were dislocated when their caves were commercialized, vandalized, or flooded. In some cases the bats were deliberately destroyed by explorers, scientists, or vandals. Most of the remaining major bat colonies live in caves readily accessible to humans. Several of these caves face future commercialization and probable abandonment by resident bats—a normal reaction to human disturbance.

Although gray bat populations have not been greatly reduced by natural predation and disease, these problems could become more significant as mortality factors.

● *The bayou darter* is a small, silvery fish known to exist only in the Bayou Pierre drainage, a small river tributary to the Mississippi River in west Mississippi. The bayou darter inhabits clean, silt-free, gravel riffle areas, but in recent years gravel pit operations and poor agricultural practices have damaged its habitat and reduced its numbers. the Soil Conservation Service has proposed a watershed project which would further degrade the bayou darter's habitat by adversely altering the water chemistry and contributing additional silt to the stream. This would pose a serious threat to the continued existence of the bayou darter.



● *The American crocodile* was once a common species in southern Florida, and old records suggest that it was occasionally present farther north on both the Atlantic and Gulf coasts. By the early 20th century the crocodile was still common throughout Biscayne Bay as well as along the shores of Florida Bay and in the Florida Keys.

Development of southern Florida eliminated much of the crocodile's habitat and also led to excessive killing by man. In the 1950's there was still significant nesting on Key Largo and on islands to the south of Florida Bay, but human pressure has eliminated most of this activity. The last suitable areas on Key Largo are rapidly being destroyed by commercial development. At present there are thought to be only about 10 to 20 breeding females in Florida, with most of these concentrated along the northeast shore of Florida Bay in Everglades National Park.

Raccoons prey heavily on the eggs and young of crocodiles, and probably destroy the great majority of the annual increment. Raccoon numbers are thought to have increased considerably after man largely eliminated natural predators, including the adult crocodiles themselves.

Poaching for skins and eggs still sometimes occurs, and crocodiles are occasionally shot for "sport" from passing boats. Although crocodiles are protected by state law, and by federal law in Everglades National Park where most of the population occurs, enforcement is difficult. Most nest sites and adult crocodiles are found in exposed areas that cannot be constantly guarded in the face of increasing human presence. Furthermore, present regulations do not restrict the destruction of habitat outside the park.

Other natural and human activities pose additional threats to the crocodile. The possibility of a hurricane or other major natural disaster is a real threat to such a small, isolated population. Increasing human development in southern Florida has restricted the flow of fresh water to the Everglades. This may greatly affect the crocodile population because young crocodiles swim upstream and depend for a period on water with low salt content.

The leopard and the clouded leopard are to be the subjects of two separate surveys by the U.S. Department of the Interior to determine if the animals should be listed as endangered or threatened species. The department is seeking the views of governments of all countries in which the leopard and clouded leopard occur.

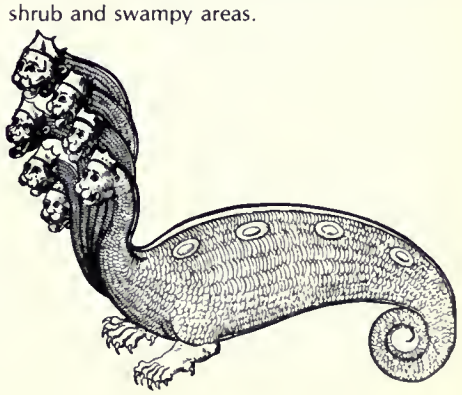
In 1972 the department declared the leopard (*Panthera pardus*) to be an endangered species throughout its natural range, primarily because of commercial exploitation which brought about a serious decline in the numbers and distribution of the animal. This designation as endangered ended the legal importation of leopards and their skins into the United States.

Scientific evidence accumulated since 1972 suggests that the leopard may not be endangered throughout its entire range. The department now has sufficient evidence to warrant a review of the leopard to determine whether it should be reclassified as a threatened species in any part of its range. This would allow some legal exploitation of the animal.

This species of leopard has the greatest range of any big cat. Found throughout most of Africa and Asia, it inhabits a variety of regions from tropical forests and rocky areas with heavy or scattered vegetation to the high, cold regions of the Himalayas. Coloration is cinnamon-buff with a rosette pattern. The "black panther" is a color phase of this species. In rocky areas the leopard lives in caves. In forested regions it lives in dense vegetation. The leopard is active and agile in trees, often springing on its prey from overhanging limbs. It usually travels in pairs, but sometimes family groups of four to six are noted.

The clouded leopard (*Neofelis nebulosa*), a smaller relative of the leopard, is not currently listed as either threatened or endangered. Recent evidence, however, indicates it may have declined to a point where its survival is in jeopardy.

The species is found only in Asia; it occurs in Nepal and Sikkim eastward to southern China, Hainan, and Formosa, Indochina, and Borneo. It frequents jungles and shrub and swampy areas.



INVERTEBRATES...

Fifty-seven species of freshwater crustaceans, including shrimp, scud, and crayfish, will be studied by the federal government, 24 states, and the District of Columbia to determine if any of them should be added to the endangered or threatened species list. The National Speleogical Society of Washington, D.C., affiliated with the American Association for the Advancement of Science, has petitioned the Department of the Interior to review the status of these crustaceans, most of which are found in caves or springs. The crustaceans are an integral part of their ecosystems and in several instances they are the primary food of threatened or endangered fish, such as pupfish, which share the same habitat. Two of the 57 species are threatened by the construction of dams, but for most of the species being studied ground-water pollution is the greatest problem. Other habitat losses can be attributed to lowered water tables, development, flooding, and strip mining.

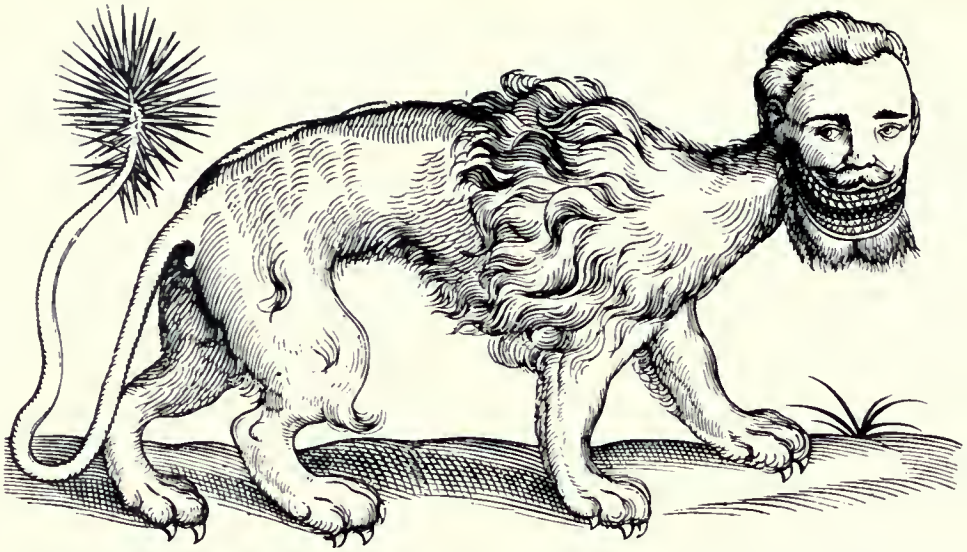
The spiny cave scud is common only to the Greenbriar Valley, a tributary of the New River in West Virgina. Strip mining is the greatest threat to this shrimplike animal. It is estimated that 90 percent of the state's freshwater mussels have been lost because of strip mining and other environmental disturbances.

In Texas, the Pecos scud is also in trouble. This scud, which can have either reddish or greenish bands, is found only in Willbanks Spring northwest of Fort Stockton. It formerly lived in many other areas along the Pecos River system, but the pumping of subsurface water, particularly in New Mexico, wiped out those populations. Currently the isolated habitat of this scud is threatened by oil drilling, a lowered water table and by pollution.

PLANTS...

The first review of plants for possible inclusion on the Endangered Species List has been begun by the U.S. Fish and Wildlife Service for four species of wildflowers.

The plants are Monkshood (*Acontium novaeboracense*) found in Iowa, Ohio, New York, and Wisconsin; Sullivantia (*Sullivantia renifolia*) found in Illinois, Iowa, Minnesota, Missouri, and Wisconsin; Bird's-eye Primrose (*Primula mistassinica*) found in Illinois, Iowa, Maine, Michigan, New York, Wisconsin, and Canada (Laborador, New Brunswick, Quebec, Ontario); and Forbe's Saxifrage (*Saxifraga forbesii*) found in Illinois, Iowa, Minnesota, Missouri, and Wisconsin. All of the species occur in very small numbers in highly isolated areas.



The wildflowers primarily inhabit the "driftless area" of Illinois, Iowa, Minnesota, and Wisconsin. The region was so named by geologists and biologists because its native plants and animals are quite unlike those of the surrounding area. The region is actually an unglaciated island of terrain in the midst of a glaciated zone. The favorite habitat of these species appears to be the moist sandstone cliffs and rock ledges of the Kickapoo River gorge in Wisconsin.

White Stork on Decline

Once a familiar sight throughout much of Europe, the white stork appears to be on the decline. Now rarely seen in Belgium, France, and the Netherlands, the bird has vanished completely from Sweden. The cause, says James Baird, a Massachusets Audubon Society ornithologist, is the use of DDT and other chlorinated pesticides. Only forty pairs of the species bred in Denmark last year, compared with 200 breeding pairs counted fifteen years ago.

New Mosquito Killer

A new pesticide recently registered by the Environmental Protection Agency (EPA) for mosquito control is Altosid SR-10, a growth regulator that prevents mosquito juveniles from maturing into adults. The insects are trapped by chemical action in their larval or pupal stages until they die. The pesticide is specific for mosquitoes, is effective in small amounts, and degrades rapidly, reports the EPA.

$50,000 Conservation Prize

Nominations are now being accepted for the second $50,000 J. Paul Getty Wildlife Conservation Prize to be awarded in February, 1976, to an individual or organization chosen by an international jury for outstanding achievement or service of benefit to mankind in the conservation of wildlife, plants, or animals. The first Getty prize was awarded last January to Felipe Benavides, of Peru. The $50,000 prize is the largest amount ever awarded for wildlife conservation.

Chairman of the international award jury of thirteen will be Prince Bernhard, of the Netherlands, who is also president of the World Wildlife Fund International.

Continuation of the prize, Bernhard said, will focus attention on conservation as a

world priority, and will provide inspiration and encouragement not only to those already at work in the field but also to those who may be thinking of becoming involved in this critically important work.

Candidates are considered for a diversity of accomplishments. These include work toward the conservation of rare or endangered species and habitats, toward increasing public awareness of the importance of wildlife and nature through scientific, educational, or aesthetic contributions, and toward the establishment of legislation or an organization or society of unusual importance to wildlife conservation. The candidate's achievement must be pioneering and substantial, so that recognition accorded by the award will increase public appreciation of the significance of wildlife and its conservation. Felipe Benavides, a Peruvian conservationist, was awarded the first Getty Prize for his successful promotion of international cooperation to save the endangered vicuña and other Latin American species and natural habitats. Benavides is using the award funds to establish a research institute at Paracas, on the coast of Peru, and proposes that a marine park be established at that location.

New Aids for Endangered Warbler

Kirtland's warbler (*Dendroica kirtlandii*), also known as the jack pine warbler, is being aided in a new program this summer in its fight against extinction. In a joint effort by the U.S. Fish and Wildlife Service, The U.S. Forest Service, and the Michigan Department of Natural Resources, forest lands in Huron National Forest, located in the northeastern part of Michigan's lower peninsula, will be burned over in order to stimulate the growth of new jack pines, the trees in which the warbler nests.

Kirtland's warbler requires jack pines from 5 to 18 feet in height for nesting. Fire pops open the cones of the jack pine which grow to a size attractive to warblers within a few years.

Since 1971, the U.S. Fish and Wildlife Service has been trapping and removing brown-headed cowbirds from warbler nesting areas to help ensure nesting success. The female cowbird does not build a nest of her own, but lays her eggs in the nests of other birds, relying on the host species to hatch and raise the young cowbirds. Before the trapping program began, cowbird parasitism was found in 59 percent of the Kirtland's warbler nests examined, and nesting success was greatly reduced by the presence of young cowbirds. The trapping program has been successful in reducing cowbird parasitism to about 9 percent, and increasing the number of warblers fledged from 0.81 to 2.84 young per nest.

This summer will be the first that Kirtland's warbler nesting areas will be closed to the public; this is being done to preclude interference with nesting success. Nesting areas will be closed from May 1 to August 15 to protect the warbler from human disturbance.

Federal Eagle-Trapping Program

Golden eagles are being trapped by the U.S. Fish and Wildlife Service in order to protect the eagle itself—an endangered species—as well as newborn lambs. The eagles trapped in southwestern Montana's Beaverhead County are being relocated to other areas of Montana and to Colorado.

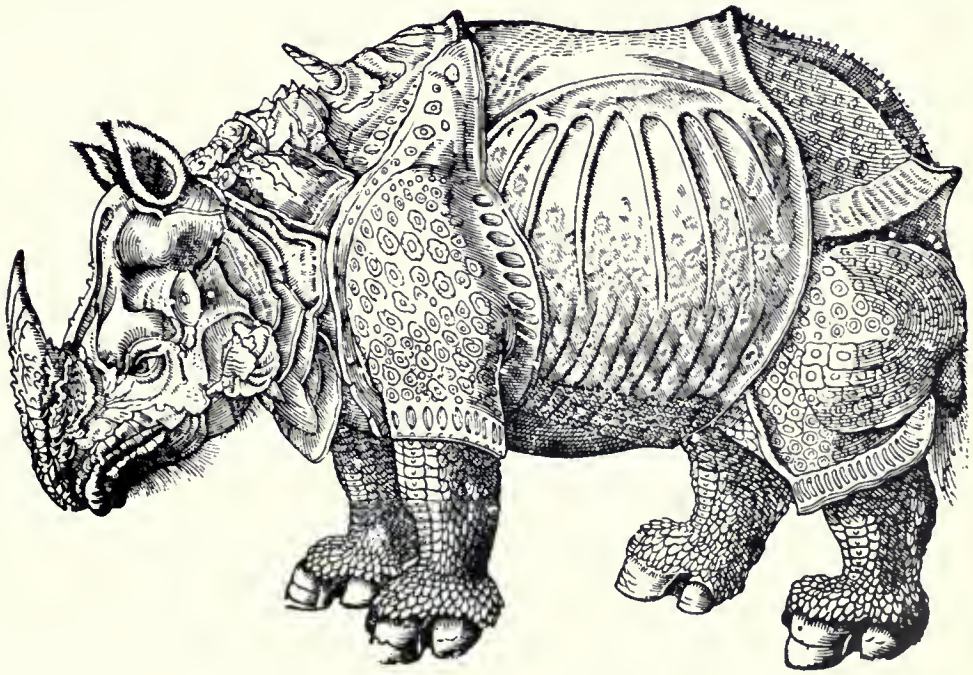
Heavy predation of spring lambs by eagles led ranchers to request authority last year to shoot the birds. Two ranchers reported losses of almost one quarter to one third of their spring crop of lambs to the eagles. The Montana Cooperative Wildlife Research Unit was assigned the task of examining lamb carcasses to determine the cause of the kills. Of 58 carcasses examined last year, 44 kills were determined to have been caused by eagles.

Under an agreement between the ranchers and the wildlife agency, the ranchers withdrew their request and the agency agreed to trap and relocate the birds. It also agreed to reimburse ranchers for documented cases of eagle-caused lamb kills. Sixty-four golden eagles were trapped and relocated prior to this year's mid-May lambing season. However, a spokesman for the federal agency was noncommittal about the projected success of the experiment.

SEA SNAKES (Con't from p. 4)

the tide comes in, large volumes of sea water go up the river. Just as the tide starts to run back out of the river, the nets are lowered into the flow and a variety of marine and brackish water creatures are caught in the nets. Although this method of fishing is not as efficient as trawling, it is excellent for catching sea snakes. Just after Chinese New Year, in February of this year, we were delighted to obtain large numbers of newly born "beaked sea snakes" (*Enhydrina schistosa*), which are rarely found in collections. For the first time, we are learning where the young live and what they eat, and we are attempting to monitor their growth and survival rate over the first months of their lives. We have even been able to maintain some baby snakes in an aquarium in our laboratory and observe their feeding behavior.

Our work in Malaysia is being done in collaboration with Lim Boo Liat, head of the Medical Ecology Division of the Institute for Medical Research (I.M.R.) in Kuala Lumpur. What we can learn about the habitats, feeding, and living conditions of sea snakes will be of use to I.M.R. in its newest project, the establishment of a snake farm in Perak, Malaysia. If we can solve the problems of maintaining sea snakes adequately for long periods in captivity, some further avenues of research will be opened. □



field briefs

African Arts Festival

A five-day summer festival, "Discovering the Arts of Africa," will be featured in Stanley Field Hall July 21 through July 25. Financial support for th festival has been provided by the Albert Kunstadter Family Foundation, Wieboldt Foundation, and Woods Charitable Fund, Inc.

- The Royal African Puppet Theatre, under the direction of Baba Alabi S. Ayinla, will appear on Monday, July 21; performances at 10:00 a.m. and 1:00 p.m. (repeat performances on Friday, July 25).
- Angie Ihejirika, textile demonstrations; Tuesday, July 22, 10:00 a.m. and 1:00 p.m.
- African dances, by John Jantuah of Ghana; Wednesday, July 23, performances 10:00 a.m. and 1:00 p.m.
- Richard Mosley (Musa) will perform on African drums on Thursday, July 24, at 10:00 a.m. and 1:00 p.m.
- The Royal African Puppet Theatre, under the direction of Baba Alabi S. Ayinla, will appear on Friday, July 25; performances at 10:00 a.m. and 1:00 p.m.

Volunteer Opportunities

For persons who wish to be volunteer teachers at Field Museum, a training course will be held one day each week beginning the first week of October through the second week of December. The course will cover general Museum orientation, offer concentration in a specific area: geology, botany, zoology, or anthropology, and provide skills required to give Museum visitors programs related to collections on exhibit. The course is limited to twenty adults. Preference will be given to persons with a strong interest and/or background in one of these areas of natural history.

There are also volunteer openings in anthropology, geology, botany, and zoology for those who are interested in familiarizing themselves with specimens, artifacts, and publications, and who can give one weekday per week at the Museum. For further information call or write Carolyn Blackmon, Field Museum, 922-9410, extension 361.

Greg Casserly Joins PR Staff

The Public Relations Department of Field Museum has recently added Gregory W. Casserly to its professional staff. A native Chicagoan, Mr. Casserly is a graduate of the University of San Diego and most recently was senior account executive at the Public Relations Center, Inc., in Chicago. Earlier, he held positions in the corporate public relations departments of Sears, Roebuck, and Co., and Michigan Avenue National Bank.

Kudos for Museum TV Commercial

A 10-second "ID" (identification) commercial for Field Museum recently won first place in the 15th annual International Broadcasting Awards competition sponsored by the Hollywood Radio and Television Society. The commercial advertised Field Museum as "Chicago's Time Machine," and, with voice-over by actor Rod Serling, strikingly showed how Field Museum exhibits take the visitor back into prehistoric times.

Museum director E. Leland Webber, above, receives the IBA "Spike" award from Laurence Senten, senior vice president and director of creative services, D'Arcy-MacManus & Masius, Inc., producers of film. William Wood-Prince, Jr., senior vice president and director of client services for the advertising firm, accompanied Mr. Senten and presented a copy of the awards dinner program to Mr. Webber.

A 30-second version of the film won honorable mention—as one of the 10 best—in the public service announcement category. D'Arcy-MacManus & Masius, Inc., supervised production of both films and contributed creative talents of the firm.

There were 3,400 entries in all contest categories, from advertising agencies in 42 countries, in the 1974 competition. The "Spike" awards were established in 1960 by HRTS, a society of broadcasting, and broadcast advertising and programming executives.

Insect-Collecting for Children

Children with an interest in collecting and studying insects will have an opportunity to do so during a special two-week course at Field Museum this summer. The program is limited to fifteen participants, age 10 through 12.

The class will meet from 10:00 a.m. to 2:30 p.m., Monday, Wednesday, and Friday from July 21 through August 1. Collecting will be done in the Museum area in the mornings and the catch will be examined and identified in the Museum in the afternoons. One full day will be spent collecting in some more distant area. Students will also be taught how to rear insects and how to make a permanent collection.

Each child should bring his or her own lunch and beverage. A nonrefundable fee of $25 for the course will also hold the reservation. Application should include child's name, address, and telephone number, and should be sent with check to Environmental Programs, Field Museum.

Attention Frog-Callers!

Some organizations have hog-calling contests; Field Museum, however, is sponsoring a frog-calling contest! The winner will receive a $10 gift certificate redeemable at the Museum gift shop.

The reason for the contest, believe it or not, is in connection with the Museum's rehabilitation program; as part of the program, an audiovisual display on frog calls is being added to the Hall of Amphibians and Reptiles (Hall 19). The display will include recorded calls, color slides of frogs, and an oscilloscope (an instrument that can make sound waves visible). Visitors will be able to see as well as hear the differences between the calls of various frog species. But the exhibit, scheduled to open in late summer, needs a title. What would you call it? Send your suggestion(s) (four words or less) to Kathleen Brennan, Department of Exhibition, Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago, Ill. 60605. Entries must be postmarked no later than July 31.

JULY and AUGUST at Field Museum

SUMMER FESTIVAL

"Discovering the Arts of Africa." One-hour programs for children and adults, Monday, July 21 through Friday, July 25, performances at 10:00 a.m. and 1:00 p.m. The festival includes demonstrations on how to wear authentic African fashions featuring colorful Yoruba and Hausa textiles, and the art of African drum carving. Baba Alabi S. Ayinla's Royal African Puppet Theatre, known for unique hand-carved wooden puppets, will present Yoruba songs, folk tales and dance; John Jantuah, of Ghana, will perform African dances. Stanley Field Hall.

SPECIAL PROGRAMS

Continuing:

Craft Demonstrations and Discussions

"African Patterns," 10:00 a.m. to 12:30 noon, Mondays, Wednesdays, and Fridays. Entrance to Hall 27.

Weaving demonstration by members of the North Shore Weavers' Guild, from 10:30 to 11:30 a.m. and 12:00 to 1:00 p.m., Fridays, through September 26. South Lounge.

Saturday Discovery Programs

A series of tours, demonstrations, and participatory activities offered continuously from 11:00 a.m. to 3:00 p.m., include Ancient Egypt, Prehistoric Man, Reptiles, Northwest Coast Art, and The World of Animals. For details, inquire at Museum entrances.

TOURS

Introductory Highlight Tours, conducted by Museum education staff and volunteers, Monday through Friday, July 7 through August 29, at 2:00 p.m. Meet at the Information Booth.

Tours of the "Ancient Ecuador: Culture, Clay and Creativity, 3000-300 B.C." exhibit, will be conducted every Tuesday and Friday through August 5, at 11:00 a.m. and 1:00 p.m. The Friday 1:00 p.m. tours are in Spanish. Meet at the Information Booth.

CHILDREN'S PROGRAMS

Continuing:

Summer Journey for Children, "A Short Walk Through Time and Places," is a self-guided tour focusing on Museum exhibits. All boys and girls who can read and write are invited to participate. Journey sheets in English and Spanish are available at the Information Booth.

MEETINGS

July 9, 7:30 **Windy City Grotto, National Speleological Society**

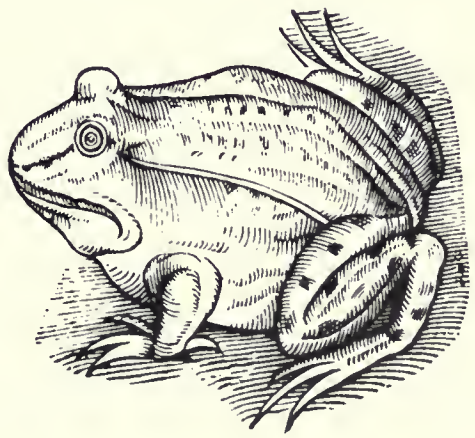
July 15, 7:30 **Chicago Audubon Society**

MUSEUM HOURS

The Museum opens daily at 9:00 a.m. and closes at 6:00 p.m. Monday, Tuesday, and Thursday. Until Labor Day the Museum will remain open until 9:00 p.m. on Wednesday, Friday, Saturday, and Sunday.

The Museum Library is open 9:00 a.m. to 4:00 p.m. Monday through Friday. Please obtain pass at reception desk, first floor north.

Museum Telephone: 922-9410



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Field Museum of Natural History Bulletin

NATURAL HISTORY SURVEY
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IRIS bulbosa latifolia, caule donata. Bauh. pin.

Papilio aristodemus ponceanus. Top left and right: female, upper and lower surfaces, respectively; bottom left and right: male, upper and lower surfaces. Photos courtesy Allyn Museum of Entomology, Sarasota, Fla. See p. 15.

Field Museum of Natural History Bulletin

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COVER

Iris bulbosa latifolia, watercolor by G.D. Ehret (1757). Painting is among 123 illustrations of plants to be exhibited at Field Museum (Hall 9) September 15 through November 16. The works, in a variety of media, were executed by 39 staff artists and botanists at the Royal Botanic Gardens, Kew, England, since the mid-18th century. The exhibit will be of special interest to historians, gardeners, and illustrators, as well as to botanists and artists. The beauty of the exhibit will be further enhanced by plant models from Field Museum's collection and by fresh-cut flowers provided by the Garden Club of Lake Forest.

PHOTO CREDITS

Cover: Museum staff photo; 2: Allyn Museum of Entomology; 4, 5, 6, 8, 9: Jeffrey W. Lang; 10 (lower left): Jim Bland; 10 (upper right): Hy Marx; 11 (lower left): Jim Swartchild; 11 (lower right): Museum staff photo; 22, 23: Allyn Museum of Entomology.

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THE FLORIDA CROCODILE: Will It Survive?

by Jeffrey W. Lang

Finding a crocodile in Florida is not easy. Clouds of mosquitoes engulfed us whenever the boat stopped. We had searched miles of coastline without seeing a single eyeshine —the conspicuous yellow-orange reflection we knew would signal "crocodile." As our small skiff skimmed over the calm waters of Florida Bay in Everglades National Park, a spotlight in the front of the boat created eerie figures among the tangled mangrove roots that reached into the water from shore. Suddenly a faint glimmer appeared in the distance, just offshore. As we approached, I was sure that at any moment the eye glowing in the darkness would drop out of sight. But we glided closer, and other features came into view: a light, tan-colored head and a long, tapering snout with a tooth protruding upwards from the lower jaw several inches from the tip of the snout. A large American crocodile (*Crocodylus acutus*) swam slowly off the bow of the boat, only an arm's reach away.

Today crocodiles are rarely seen in the park, even though their presence there has been known for years. Unlike the alligator, which is widely distributed throughout the southeastern United States, the crocodile is restricted to the southeastern coast of Florida. A century ago, the species ranged from about Lake Worth on the east coast south into the Miami area and west through the Florida Keys. At present, crocodiles occur on North Key Largo and in eastern Florida Bay, with scattered records from the lower Florida Keys. Recent estimates place the entire population in the United States at between 200 and 400 individuals; of these, only 25 or less are breeding females.

For us, getting so close to a crocodile was a pleasant surprise and an encouraging sign. On previous nights, we'd looked in vain for hours. When we did see a crocodile, it would dive out of sight before we could approach. It was

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Jeffrey W. Lang is a doctoral candidate in the Department of Ecology and Behavioral Biology at the University of Minnesota. *His research on crocodilians has been supported by the New York Zoological Society, the Dayton Natural History Fund of the Bell Museum at the University of Minnesota, the Bache Fund of the National Academy of Sciences, and the Society of Sigma Xi.*

◄ *Crocodile hatchlings with radio transmitters attached.*

late July of 1973; and I was collaborating with John Ogden, a research biologist with the park staff, on a pilot project to mark and study the crocodiles in Florida Bay. Several rangers who had handled alligators were assisting us. Because crocodiles tend to be more aggressive and dangerous than alligators, experienced helpers were welcome.

As our boat headed for shore, the crocodile unexpectedly climbed out of the water onto a high marl bank and went crashing through the brush. We scrambled after it, dropping our gear and grabbing for headlamps. After a brief chase, the crocodile was surrounded, hissing at us whenever we approached. Finally, one of the rangers pinned down its head with a long pole and held its jaws closed, while two of us gently eased onto its back and tail. Carefully, the crocodile's snout was taped. Amazingly, the crocodile didn't struggle. I'd read that, once captured, crocodiles become lethargic; in this instance, I was happy to confirm it. With two men sitting on the crocodile's back, we quickly took body measurements, marked several tail scutes in a distinctive pattern, and released the eight-foot female unharmed—our first crocodile was marked.

Investigations of the biology of the American crocodile are long overdue. Surprising as it may seem, throughout the species' range—in Florida, the Greater Antilles, and parts of Central America and northern South America—very little is known about its natural history. For instance, what do crocodiles eat? Where do they live? When are they active? Are crocodiles social? How do they breed?

Exciting answers to some of these questions are beginning to emerge from the studies conducted by John Ogden in the Everglades National Park. Starting in 1969, his first efforts involved searching for nests and patiently waiting for glimpses of the animals that made the nests. Within several years, eight nesting sites were located, but the crocodiles were almost never seen. So, at a few of the nests, remote-control cameras were set up to monitor the crocodiles when they visited the nests. The resulting photographs document many of the behaviors associated with nest-building, nest attendance, and hatching.[1]

Over a period of weeks, every April and May, female crocodiles construct their nests along the sandy beaches and marl banks of eastern Florida Bay. Some are large mounds of sand that are visible a quarter-mile away; others are mere holes in the ground that are barely distinguishable from the surrounding terrain. Each female lays about 20 to 60 eggs, and then visits her nest frequently, often at night. At the end of the 100-day incubation period, she excavates the nest, carrying newly-hatched young to the water in her mouth.

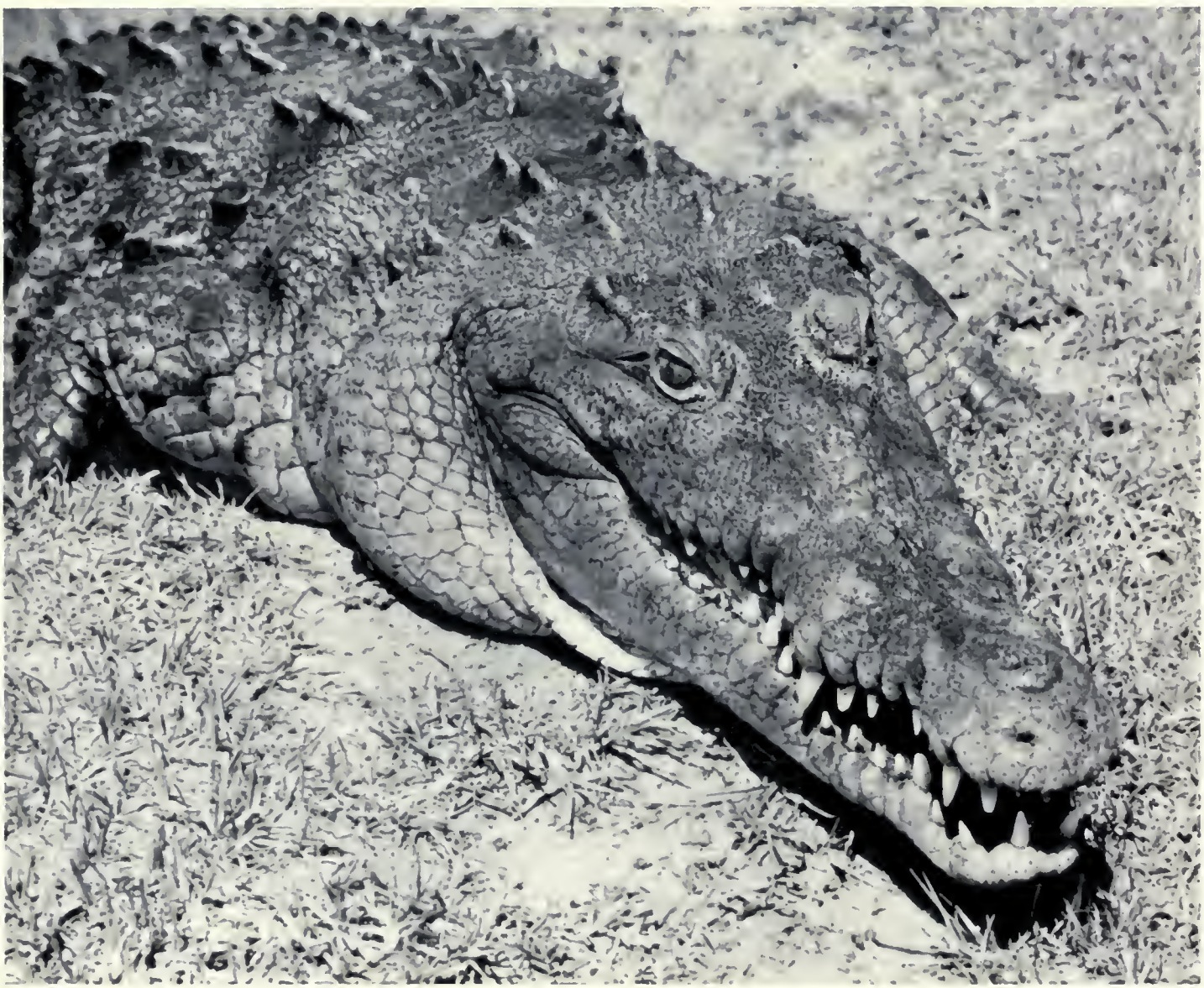
Such attentive care of the young may be typical of birds and mammals, but it is a rare trait among reptiles. Compared to the other reptilian groups, crocodilians show exceptional care for their eggs and young. Females even guard their hatchlings against predators, according to one report on another species. We were anxious to learn how long a female crocodile stays with her young. Marking a family of American crocodiles at nesting time looked like a good way to find out.

We hoped to capture a female near her nest, equip her with a miniature radio transmitter, and then tag the young when they hatched. In this way, we could follow the mother and her young with a portable radio receiver, document their behavior, and identify the habitats they preferred. Importantly, the study would also give us a chance to develop and evaluate techniques for learning more about these shy and unusual reptiles.

Baby crocodile emerges from egg after three-month incubation. An egg tooth at tip of upper jaw serves to puncture the inner leathery shell. The brittle outer shell cracks away at hatching. ➤

Day-old crocodile hatchling. Weight: about 3 ounces; length: 11 inches.

The business end of an adult American crocodile. Its narrow, tapering snout and light coloration distinguish it from the American alligator. Adults sometimes reach 15 feet in length and may weigh half a ton.



Apparently, our first marked crocodile did not have a nest in the vicinity, so we looked for another candidate for attaching the telemetry equipment. A few days later, a second female was trapped near her nest and outfitted with a transmitter. But "Black Betsy," named for the key where she nested, wasn't very cooperative. After weeks of searching, we were still never able to relocate her. The radio may have malfunctioned, or perhaps the disturbance so close to the time of hatching scared her away.

Fortunately, her young were more willing. Altogether, we tracked 28 hatchlings for periods of 2 to 15 days. At first the young clustered within several feet of each other on the shoreline near the nest. But after several weeks, they had dispersed, some as far as 200 yards from the nest. The baby crocodiles spent most of the daytime hiding among mangrove roots and under leaves and debris near the water. At night, particularly between dusk and midnight, they were more active.

Contrary to predictions, the hatchlings seemed to tolerate salt water quite well; some workers have suggested that they move into fresh water soon after hatching. In general, the young preferred shallow, protected areas on the inland side of the key. As we expected, predation was very high, at least for these young without a mother around. Various tracks and signs near the radios we recovered suggested that racoons were the villains. Ironically, raccoons have become abundant in south Florida since many of their predators, including crocodiles, have been reduced in numbers or eliminated by man.

Following crocodiles in the wild is not the only way to study their behavior. At a unique alligator farm, known as "Gatorama," in south central Florida, I have been observing and filming the behavior of captive American crocodiles. Within the large, spacious enclosure, adult crocodiles cruised around a three-acre lake and went about their daily business of feeding, basking, and socializing. Actually, a casual first glance didn't reveal the complex social structure that really existed. But as I watched day after day, I saw frequent encounters between animals and subtle behaviors that I hadn't noticed initially. Many of the crocodiles had distinctive markings, and I marked certain others. In this way, I was able to identify individuals and watch their behavior for several months at a time.

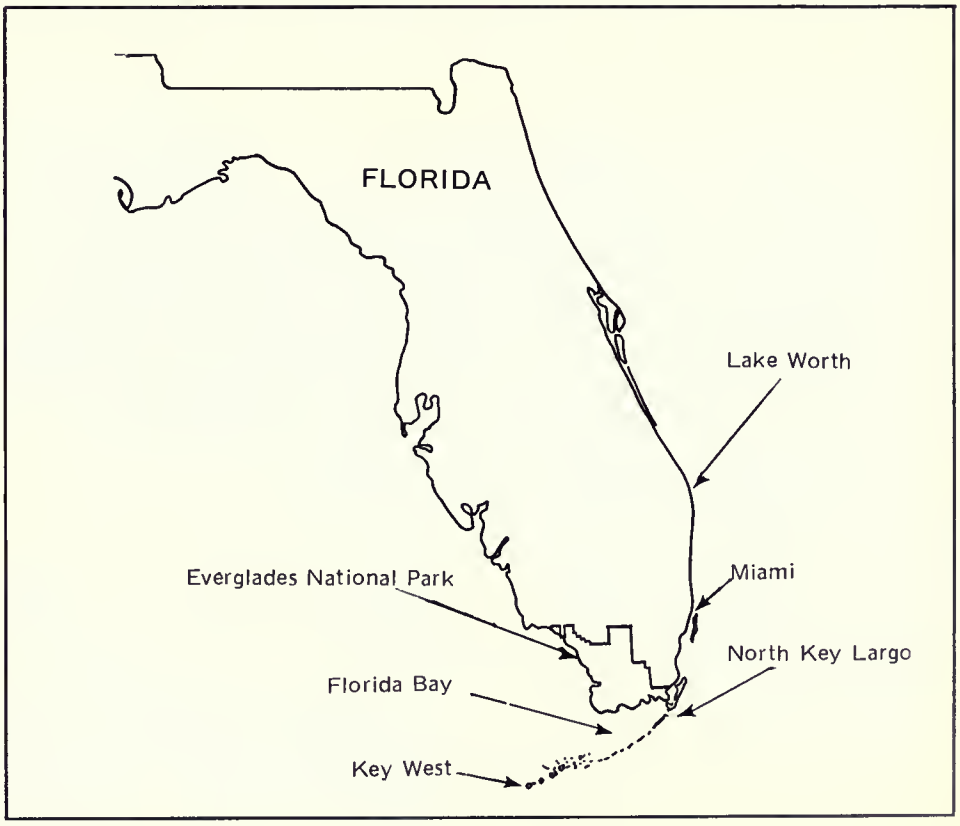
Like many animals, crocodiles are territorial during the breeding season. Three large males divided up the enclosure early in the spring; and each resident male patrolled his territory often, excluding other males. Territorial boundaries served as neutral zones where the nonterritorial males sought refuge, but the females moved from one territory to the next with impunity. A crocodile's whereabouts was circumscribed largely by his relative position in the "pecking order." Consequently, every crocodile that I could identify had a predictable pattern of basking, feeding, and moving within the enclosure. I had a feeling as I watched that each individual noticed and distinguished among its neighbors and acted accordingly.

Resident males advertised their presence by "headslapping." In this display, the head is lifted up and then slapped suddenly onto the surface of the water. Simultaneously, the jaws are opened and closed quickly as the head hits the water. The cumulative effect is a popping sound audible some 200 yards away and loud enough to wake a sound sleeper. The resident males I watched headslapped one to three times in rapid succession, usually in response to a neighbor's headslap or when an intruder entered a resident's territory.

Social interactions occurred more frequently during the breeding season, but fighting was observed only rarely among these American crocodiles.

On one occasion, two males of similar size squared off, lunged at each other with opened jaws, grappled briefly, and then separated. Each displayed the "arched-back" posture in which the back is arched and the body inflated. The purpose of this display seems to be intimidation of the opponent. Another display, tail wagging, was performed by the dominant male just prior to his attack. But usually, subordinate males were chased hastily out of an occupied territory by the resident male. Biting, when it did occur, was stereotyped: the attacker would grasp its opponent by the base of the tail with its jaws, then quickly release its hold. Only minor damage was inflicted during these skirmishes, but the message seemed to be clear.

Submission was signalled by the "head-up" gesture. In this display, the



head is lifted out of the water, and the snout pointed upward at an acute angle to the water. Often, the jaws are held open, exposing the bright yellow interior of the mouth. Females and possibly subordinate males lifted their snouts when they were approached by a large male, particularly a resident. If the initial gesture failed to halt an advance, the snout was lifted higher, and lowered, and lifted again. Paradoxically, a crocodile's open jaw in this context signaled appeasement rather than aggression.

Courtship was a relaxed, yet complex activity. The sequence of events was quite variable and often continued intermittently for days. Typically, the female approached a potential suitor, usually one of the resident males, with her snout lifted upward in the "head-up" posture. If the male remained stationary, the female lifted her head onto his neck and back, circled behind him, and then repeated the performance on his other side. Eventually, the male assumed a characteristic posture with his head and tail out of the water. A period of elaborate circling by both partners followed; their heads were lifted and in contact. Circling continued until the male swung around on top of the female's back; with the female almost completely submerged, copulation took place underwater.

Typical Florida Bay shoreline of a Florida key, where mangrove prevails. Baby crocodiles sometimes conceal themselves in seaweed washed up onto the shore.

Crocodile nest (dark area at center) on North Key Largo. In 1973 this nest produced hatchlings despite nearby construction project. In 1974 the road at lower right was constructed and the nest was abandoned.

As I watched the crocodiles court, I was reminded of the elaborate courtship patterns of many species of birds. In some respects, the behavior of birds and crocodilians is remarkably similar. For instance, both groups vocalize. Alligators engage in a variety of bellows, growls, purrs, hisses, and grunts, all of which appear in certain contexts and probably convey specific messages. Other species, like the American crocodiles I watched, only growl occasionally as adults. But in all species studied so far, vocalizations are important in the mother-young relationship. When a baby crocodile grunts, adults as well as other young respond. Some observers have likened a "pod" of grunting, hatchling crocodiles to a brood of quacking ducklings. Care of the young, as noted earlier, is another behavioral characteristic that crocodilians share with birds. Although at this point we are not sure just what kind of parents crocodiles make, the degree of parental care they show is impressive, at least for reptilians. Possibly, the behavioral affinities between birds and crocodilians reflect the past evolutionary history of the two groups. Crocodilians share their archosaurian ancestry, dating back some 200 million years ago, with the birds and the dinosaurs. Perhaps the extinct dinosaurs also cared for their grunting young as the crocodilians do today.

But, in order to generalize about crocodilian behavior, we need to know much more than we do now. Of the twenty-one species of crocodiles, alligators, and gavial living today, only a few species have been studied in any detail. Already we know that certain displays, such as the "headslap" seen in the American crocodile, are performed by the Nile crocodile and the American

alligator as well.[2] Future comparisons between species should prove interesting. Studies on captive animals are a valuable first step in understanding behavior; but, ultimately, field studies such as the one we initiated in Florida Bay will be necessary in order to appreciate the role of behavior in natural populations. As a matter of immediate concern, information of this sort is essential for making wise decisions about the management and preservation of the species.

We will have to act soon. Habitat destruction threatens the continued existence of the American crocodile in Florida. Today, crocodiles occupy only a fraction of their former range. Unfortunately, this narrow strip of land is within an area that is being modified intensively by man. Crocodiles once lived on the shores of Key Largo and throughout the Miami area, but these localities have been altered so extensively that there are simply no longer any habitats or crocodiles left. Suitable habitat is protected within the Everglades National Park. Even so, we don't know enough about the habitat requirements of crocodiles to say with certainty that the area within the park is large enough to support a stable population.

Outside the park, crocodiles still occur in the North Key Largo area. In the spring of 1973, I found crocodile nests from previous years at two localities there. By the middle of the summer, a dredge-and-fill project was underway at one site. As I searched for a nest I'd seen in the spring, I realized that it was buried beneath the road I was standing on. Somehow, a few crocodiles were able to nest. In early August, I discovered fifteen hatchlings in the water near a recently hatched nest. Less than 100 yards away, a diesel dragline was scooping up the mangroves, apparently paving the way for another seaside trailer court. The fate of these young crocodiles certainly looked bleak.

For years, crocodiles in Florida were hunted and killed for their hides. Writing about Florida Bay in 1908, A.W. Dimock said: "Before every crocodile cave, a picket fence tells of an attempt to capture its occupant."[3]

By the early 1940s; a museum curator thought it noteworthy that he took two trips through Florida Bay with an experienced crocodile hunter before finding a single adult. By the 1950s, the number of crocodiles in Florida had been reduced dramatically; finally, some respite was afforded with the creation of Everglades National Park. In the 1960s, killing a crocodile was prohibited under state law; but there was little attempt by the state to protect those that remained. presumably, by then, crocodiles were thought to be too scarce to warrant much attention.

Tragically, the killing goes on. Crocodiles are shot deliberately by construction workers as the mangroves are cleared. Each year, others die on the busy highways. In early April of this year, local law officers captured and shot an 11'9" adult male crocodile while they were searching for evidence of a crime in a shallow lake on North Key Largo.[4] When questioned about why the crocodile had been killed, they offered conflicting explanations about the safety of their divers, the need for an examination of the stomach contents, and the poor health of the crocodile. On subsequent examination, it was determined that the crocodile was in good health and that its stomach was empty. Simply restraining the animal (since it had been captured) would have been ample protection for the divers. This senseless shooting was clearly illegal under Florida law, but state authorities were reluctant to prosecute. To some, killing a large crocodile must seem quite heroic when, in fact, it involves little risk and takes minimal courage to shoot these shy, if powerful, animals.

Shortly after the incident on North Key Largo, the U.S. Fish and Wildlife Service announced that the American crocodile is endangered in the United States.[5] By early fall, crocodiles will be afforded federal protection under the Endangered Species Act of 1973. Our first priority should be to identify the crocodile habitats outside the park—primarily in the North Key Largo area—and take steps to preserve these habitats and to protect our remaining crocodiles vigorously. The Endangered Species Act contains provisions for land acquisition should this prove necessary. Perhaps, with more public education and governmental cooperation, on a future visit to the Florida Keys, one might be able to see signs reading: "Caution: Crocodile Crossing Ahead." □

Mutilated carcass of 11'9" American crocodile killed illegally in April, 1975 on North Key Largo. Law officers who participated in the shooting removed the belly skin and chiseled teeth out of the skull for souvenirs.

1. "Night of the Crocodile" by J.C. Ogden, and C. Singeletary, *Audubon* 75(3):32-37 (May, 1973). An article by Ogden (*Animal Kingdom* 74:7-11, Dec., 1971) summarizes research on Florida Bay crocodiles.
2. Alligator social behavior is described by L.D. Garrick in *Animal Kingdom* 78(2):8-8 (April/May, 1975).
3. *Florida Enchantments* by A.W. and Julian A. Dimock (Outing Publ. Co. New York, 1908), p. 298.
4. *Miami Herald*, April 10, 1975.
5. *Federal Register* 40(77):17590-91 (April 21, 1975).

field briefs

Bulletins, 1930-75, Available

Conrad Lachel, manager of publications at Field Museum, reports that back issues of the *Bulletin* are available (with few exceptions) from 1930 to the present. They may be ordered from the Division of Publications at 75c each, postpaid.

Quetico Canoists Return

The idyllic, misty view below, left, was taken by Jim Bland, instructor with Field Museum's Department of Education, during the recent canoe trip, sponsored by the Museum, in Ontario's Quetico wilderness. Thirty-five young people (ages 15 through 18) and five Field Museum staff persons made the exciting eight-day trip.

Frog Photo Now Available

Following publication of the June, 1975, *Bulletin*, the magazine office received a large number of requests for reproductions of that month's cover photo of the red-eyed Central American tree frog (above, right). We are pleased to report that 8x10 glossy color reproductions of the photo (by curator Hy Marx), suitable for mounting, are now available by writing the editor. The price is $4.00 each, postpaid. Check or money order should be payable to Field Museum.

Easter Seal Society Award

Field Museum was the recent recipient of the first annual National Awareness Week Award, given by the Easter Seal Society of Metropolitan Chicago. The basis of the award was the Museum's ongoing program to make the bulding and its facilities barrier-free and easily accessible to handicapped persons.

In accepting the award, Museum Director E. Leland Webber observed that "this award really belongs to the late Dr. Eleanor Leslie for her bequest, and to Stanley S. Kresge, William H. Baldwin, and the Kresge Foundation for a generous grant, which will allow us to make Field Museum barrier-free to the physically handicapped. So, with appreciation for their vital financial help, I thank the Easter Seal Society for honoring Field Museum."

Staff Notes

August 1 was a red-letter day for John Bayalis, head of Field Museum's Division of Photography, for it marked the beginning of his second half-century with the Museum. On that date, in 1925, 18-year-old John was hired as "flower, foliage, accessory worker, Harris Extension." In 1948 he transferred to Photography, where he has been head since 1950.

Matthew Nitecki was promoted to curator, fossil invertebrates, on July 1. Dr. Nitecki joined the Museum as assistant curator in 1965 and in 1970 was made associate curator.

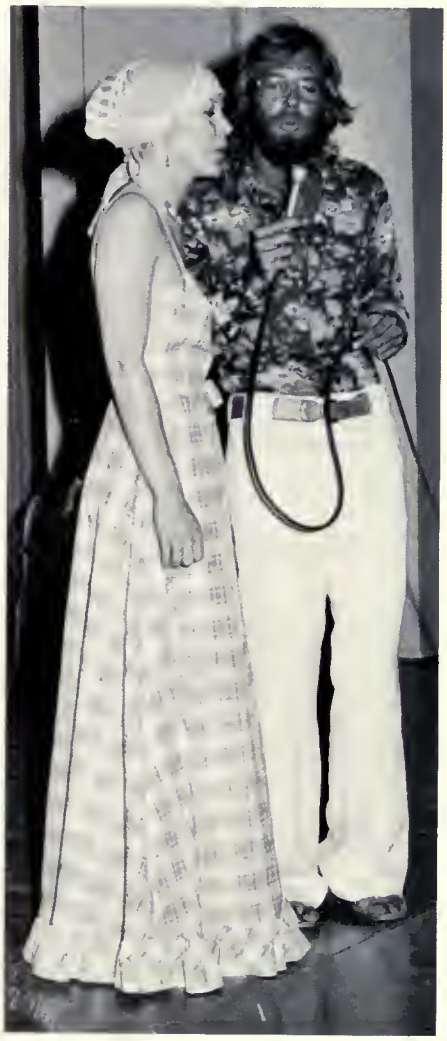
The latest addition to the Department of Botany staff is Helen A. Kennedy, who has

been named assistant curator of botany. She received her doctorate at the University of California, at Davis, in 1974, and subsequently held a fellowship at the Smithsonian Institution, Washington, D.C.

Ronald A. Testa, who most recently was a photography instructor in New York City, has been named Field Museum photographer. Ron holds a BFA in photography from the Cleveland Institute of Art and an MA in photography from the Visual Studies Workshop, Rochester, N.Y. He has also been a photographer for the Cleveland Institute of Art, the Cleveland Museum of Art, and the United States Navy.

Field Museum Staff Party

Below, left, Nika Semkoff (Public relations/Education) and Bob Kosturak (Exhibition) provide vocal entertainment at a recent dinner party given by and for Field Museum staff. Entertainment also included renaissance and bagpipe music and demonstrations of magic. Dancing rounded out the evening.



William Beecher to Speak

William Beecher, director of the Chicago Academy of Sciences, will be special guest of the Nature Camera Club of Chicago at its monthly meeting, Tuesday evening, Sept. 9, at 7:30 p.m., at Field Museum. A well known ecologist and ornithologist, Dr. Beecher will speak on "Photographing Birds at High Altitudes." Guests are welcome.

Pupeteer Baba A.S. Ayinla Performs

At right, puppeteer Baba Alabi S. Ayinla with his Royal African Puppet Theatre is shown performing in Stanley Field Hall during a recent five-day summer festival, "Discovering the Arts of Africa."

Volunteers Catalog Sea Snakes

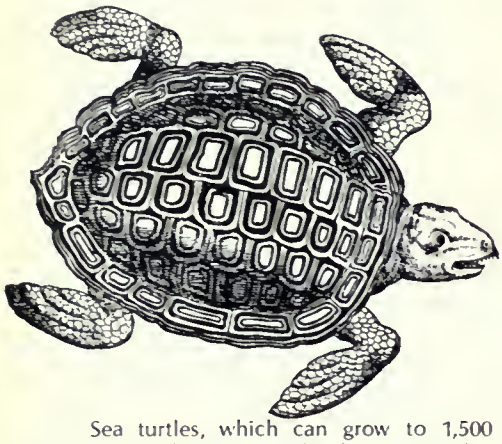
Below, right, Alan Resetar, a volunteer in the Division of Amphibians and Reptiles, catalogs some of the many sea snakes recently collected in the Straits of Malacca by Harold Voris, assistant curator of amphibians and reptiles. Volunteers Gretchen Anderson and Sandra Walchuk also assisted in the cataloging of the snakes. (See July/August 1975 *Bulletin*.)

our environment

Sea Turtles in Trouble?

Three more species of sea turtles have been pushed closer to extinction because of increased development of coastal shorelines and overuse for commercial purposes.

The green (*Chelonia mydas*), loggerhead (*Caretta caretta*), and Pacific ridley (*Lepidochelys olivacea*) sea turtles have been proposed in the *Federal Register* to be added to the U.S. List of Threatened Wildlife by the U.S. Fish and Wildlife Service, Department of the Interior, and the National Marine Fisheries Service, Department of Commerce. The proposal came after a joint status review by both agencies found seriously decreased populations of these species throughout the world. The leatherback, hawksbill, and Atlantic ridley sea turtles are already on the U.S. List of Endangered Wildlife.



Sea turtles, which can grow to 1,500 pounds, rarely come on land except to lay eggs. Human development of coastal areas for industry and tourism has destroyed many of these nesting sites. Along some shorelines, bright city and highway lights confuse hatchlings and attract them inland where they die.

The green sea turtle is probably the most commercially valuable reptile in the world and one of the most heavily hunted. Its meat, eggs, and calipee (cartilage used in soup) have been eaten for centuries, its skin has been used for leather, its shell has been used for jewelry, and its oil has been used in the cosmetics industry. An international market in turtle products now exists, with the United States being among the largest consumers.

In the last few years there has been a rise in the commercial take of the Pacific ridley, stimulated by the development of a market for a turtle leather, partly as a substitute for alligator hides.

Both the green and loggerhead are found around the world, with some populations nesting on various shores and coastal islands in the southeastern United States and its territories and possessions. The Pacific ridley also nests in many parts of the world, but is not known to nest in the continental United States.

Although most states where the turtles are found protect the reptiles, other countries either permit or cannot prevent the commercial taking of turtles and eggs. The lack of restrictions on importing turtle products into this country may be encouraging this exploitation.

If adopted, the new regulations would prohibit the taking, import, and export of the species and would halt the United States involvement in the sale in interstate the foreign commerce of these turtles and products made from them.

There would be certain exceptions to the prohibitions. Sea turtles could be taken by permit for scientific purposes, enhancement of propagation, or survival. The incidental catch of sea turtles during fishing or research activities would be exempted provided that the turtles were immediately returned to the sea and that the fishing was not taking place in an area of substantial breeding and feeding by these species. Permits would be authorized for mariculture operations (scientific breeding and raising of sea creatures for commercial use) for two years if there is a showing of significant progress toward a goal of creating a captive breeding population that is completely self-sustaining and independent of wild stocks. After two years permits would be available only if turtles were taken from captive bred populations completely self-sustaining and independent of wild stocks. Certain live specimens and products held on the date of the regulatory proposal would be exempted from the prohibition.

The prohibition on interstate commerce would not take effect until one year after the regulations become effective, thereby allowing owners to distribute inventory lawfully possessed. Permits would also be available for economic hardship.

Federal-State Aid for Everglades Kite

The Florida Everglade kite's chances for survival in Florida have been enhanced by the establishment of a cooperative federal-state team of experts who will give priority to restoring the populations of this hawk.

The team's primary objective is to coordinate actions to restore the Everglade kite to as much of its former range as possible, after drawing up a detailed plan which will schedule specific actions needed.

The Everglade kite (*Rostrhamus sociabilis plumbeas*) is a predatory bird, similar to a marsh hawk, and related to the falcon. It is one of several kinds of snail kites that occur in Central and South America. At one time the Florida Everglade, or snail, kite was distributed throughout peninsular Florida in freshwater marshes. At present it is restricted primarily to southeastern Florida and is thought to number less than 100 individuals.

The original population was severely reduced because of destruction of habitat and shooting. Drainage of marshes for agricultural and residential use continues to be a major factor in the decline of this bird. These problems plus drought and fire have reduced populations of the large apple snail (*Pomacea paludosa*) on which the kite depends for food. The major threat to the remaining kite population involves maintenance of proper water levels in its habitat for snail production and maintenance of nesting cover. In recent years the flow of water from Lake Okeechobee to the Everglades has been reduced by drought and diversion to agricultural areas.

Some constructive steps have been taken to assist the kite. Educational programs by the Florida Game and Fresh Water Fish Commission, the U.S. Fish and Wildlife Service, and the National Audubon Society are intended to discourage indiscriminate shooting and publicize the plight of the kite. Numerous signs depicting this bird dot the marshes of southern Florida. Sanctuaries and known nesting areas are regularly patrolled. Portions of the Loxahatchee National Wildlife Refuge where kites nest are closed to entry during the nesting season.

Research is also underway in the field and at the Fish and Wildlife Service's Patuxent Wildlife Research Center to ascertain the status of the kite, to determine conservation methods, and to develop techniques for increasing production of apple snails. South American snail kites, one of four subspecies of Everglade kite, are being reared at Patuxent to develop information on snail kite habitat requirements.

Adult Education Programs
Field Museum of Natural History
Roosevelt Road at Lake Shore Drive
Chicago, IL 60605

Enclosed is my check for $_____ , payable to Field Museum.

Course title _____

Name _____

Address _____

City _____ State _____ Zip _____

Phone _____
daytime evening

Courses for Adults

Thursday Evenings
October 16–November 20

A NEW series of courses in the natural sciences and anthropology is being offered at Field Museum beginning in October. Each course is designed to give participants maximum exposure to the Museum's main resource—real things. Thus, individuals will learn about fossils by studying real fossils, or learn about a culture by studying the artifacts that reflect that culture's values and beliefs.

These noncredit courses are offered at an introductory undergraduate level and are open to anyone over 18. Fall courses will be held on six consecutive Thursday evenings, from 7 to 9 p.m., beginning October 16. Additional courses will be offered in winter and spring.

A registration fee of $25.00 for Museum members, and $30.00 for nonmembers, is required for each course. Advance registration by mail is requested, but registration will be accepted during the hour preceding the first meeting if the course is not filled. Courses are limited to 30 participants, minimum enrollment 15.

For further information, write ADULT EDUCATION PROGRAMS, at Field Museum, or call 922-9410, ext. 351

REPTILES AND AMPHIBIANS

Charles Kroon, Committee on Evolutionary Biology, University of Chicago

An ecological approach to the biology of reptiles and amphibians. Topics include the evolution, geographic distribution, ecology, and behavior of these cold blooded vertebrates.

FLOWERS AND POLLINATION

Helen Kennedy, assistant curator of botany

An introduction to the biology and reproduction of flowering plants. The course will focus on the interactions between flowers and their pollinators, including butterflies, moths, birds, bats, and bees. Examples will be drawn from the tropics as well as from temperate areas.

CULTURES OF NATIVE NORTH AMERICA

John White, Native American Program, Department of Education

A survey of Native American cultures with emphasis on the Southwest, the Plains, the Northwest Coast, and the Eastern Woodlands. These cultures will be approached through investigation of artifacts from Museum collections and exhibits, with a final session devoted to demonstration of various crafts techniques and preparation of traditional foods.

OCEANOGRAPHY

Robert Johnson, assistant curator of fishes

This course will incorporate aspects of geology, chemistry, physics, and biology to provide an overview of marine systems. Topics for investigation will include the origin and evolution of oceans, marine ecology, and food production in the sea.

ROCKS, FOSSILS, AND MAN

Katherine Krueger, Department of Geology

Specimens from the Museum's geology collections will be used in laboratory sessions devoted to methods of identifying minerals, rocks, and fossils. Laboratory work will be supplemented by discussions of the evolution and classification of major fossil groups, with final emphasis on paleoecology and economic geology.

◄ TO REGISTER, USE COUPON ON FACING PAGE (OR FACSIMILE)

Man's One World

A film-lecture series focusing on the impact of ecological disturbance upon a number of traditional cultures. Anthropologists will lead discussions and answer questions about these pressures and changes.

October 3,4
"The Tribe that Hides from Man"
Speaker: Bennet Bronson, assistant curator, Asiatic archaeology and ethnology. An expeditionary search strikes terror into the Kreen-Akore tribe in Brazil's Amazon jungle; the purpose of the search is to aid the Indian against the encroachments of civilization.

October 10, 11
"The Turtle People"
Speaker: Mary W. Helms, lecturer in anthropology, Northwestern University The coastal Miskito Indians of eastern Nicaragua have depended on the green sea turtle to sustain them for more than 350 years. This program offers a unique perspective on the ecology of economics.

October 17, 18
"The Last Tribes of Mindanao"
Speaker: Phillip Lewis, acting chairman, Department of Anthropology; and curator, primitive art and Melanesian ethnology. A small group of aborigines, the Tasaday, lived undisturbed by civilization for more than 400 years in the rain forest of Mindanao, the Philippines. In 1971, they were discovered. This documentary may be the last chance to see the Tasaday's way of life before outside contacts and pressures bring about changes.

October 24, 25
"The Ice People"
Speaker: James VanStone, curator, North American archaeology and ethnology. Man adapted to the Arctic more than 10,000 years ago; now he must adapt again. What happens to Eskimo traditions and skills, to strong family ties, and a life of sharing, where freedom and individuality are prized?

October 31, November 1
"Man of the Serengeti"
Speaker: Glen Cole, curator, prehistory. Nearly 400 years ago Masai warriors fought their way from the Upper Nile to the Serengeti Plains. Most Masai descendants consider themselves as "warriors," with their spears and traditions. Must they inevitably lose their final battle against time and change?

*November 8, 9
"The Village"
Speaker: Paul Hockings, associate professor of anthropology, University of Illinois, Chicago. Filmed by Dr. Hockings and Mark McCarty in 1967, the village of Dunquin, Ireland, is shown as an intimate study of people molded by several environmental factors. This film and discussion are about a language, customs, and subsistence techniques of the past, possibly presented for the last time.

November 14, 15
"Ishi in Two Worlds"
Speaker: John White, consultant, Native American program. This film presents the story of the Yahi Indians of California and of Ishi, the last Yahi. By 1911 he was the sole survivor of his people. How could this happen?

November 21, 22
"Sky Chief"
Speaker: Donald Collier, curator, Middle and South American archaeology and ethnology. The third world: Ecuador. A film discussion about the cultural and economic clash of different forces and the ecological disruption that follows.

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* *The Saturday, Nov. 8, program at 2:30 p.m., will be for members only, in conjunction with the opening of the "Man in his Environment" exhibit and related special programs. The Sunday, Nov. 9, program at 2:30 p.m., will be open to Museum visitors as well as to members.*

All programs (except the Nov. 8 and 9 programs, noted above) will be given in the ground floor lecture hall on Fridays at 7:30 p.m. and repeated on Saturdays at 2:30 p.m. All programs will be free to nonmembers (except, as noted above, on Saturday, Nov. 8). Total attendance for each day's program limited to 225 adults. Previous programs have been presented in the larger James Simpson Theater. That area is currently being renovated, however, in order to provide barrier-free access to the building for the handicapped.

Food service will be available in the Museum cafeteria until 7:30 p.m. on Friday evenings during this series.

This project is partially funded by a gift from Mr. and Mrs. Ray A. Kroc and grants from National Endowment for the Humanities, Field Foundation of Illinois, and the Charles E. Merrill Trust.

Threatened Status for Two Butterflies?

A Proposal by the U.S. Department of the Interior and an Entomologist's Rebuttal

The status of two American butterflies has suddenly become a cause celebre, at least among entomologists and environmentalists. In the *Federal Register,* April 22, the Department of the Interior proposed that Schaus' swallowtail (*Papilio aristodemus ponceanus*) and the United States population of the Bahama swallowtail (*Papilio andraemon bonhotei*)—two of the showiest and most beautiful of the American butterflies—be listed as threatened species. They would thus become the first invertebrates in the United States to be so classified.

On May 23, Lee D. Miller, a Field Museum research associate and curator of the Allyn Museum of Entomology, Sarasota, Fla., responded in a letter to the Department of the Interior, urging that the matter be considered further. The thrust of Miller's argument is that it is the habitats, not the butterflies, that might be considered "threatened."

The USDI proposal had come as no surprise to butterfly-watchers, for both insects and their scarce, irregular occurrence had been the subject of publicity for a good many years. Most recently, *National Parks & Conservation Magazine* (July, 1974) had carried a feature article, "Haven for Rare Butterflies," by Larry N. Brown. A specialist in terrestrial vertebrate ecology and associate professor at the University of South Florida, Tampa, Brown related the scarcity of both species to "overzealous collecting activities by man. . . . The greatest threats to their populations seem to be habitat destruction by man or hurricane and overcollecting by dealers and lepidopterists. Because their prime habitat is now fully under the control and protection of the National Park Service, there seems little chance of total habitat destruction due to man's activities." Brown concludes that "Because of their limited habitat and the impending threat of increased collecting and destruction due to increased accessibility and development of the islands, the Department of the Interior should list the Schaus' and Bahaman swallowtails as endangered or threatened species."

Following is the text of the USDI proposal as it appeared in the April 22 *Federal Register:*

Background. The United States Fish and Wildlife Service has evidence that the following species of insects are threatened species as defined by the Endangered Species Act of 1973 (16 USC 1531-43; 87 Stat. 884): Schaus Swallowtail (*Papilio aristodemus ponceanus*); and the United States population of the Bahama Swallowtail (*Papilio andraemon bonhotei*).

Section 4(a) of the Endangered Species Act of 1973 states that the Secretary of the Interior may determine a species to be an endangered species, or a threatened species, because of any of five factors. These factors, and their application to the Schaus Swallowtail and the Bahama Swallowtail, are as follows:

1. *The present or threatened destruction, modification or curtailment of its habitat or range.—Schaus Swallowtail.* The original range of this butterfly in the United States was from South Miami south through the offshore islands and larger keys to Lower Matecumbe Key, including Elliot Key, Sands Key, Key Largo, Lower Matecumbe Key, Old Rhodes Key, Totten Key, and possibly Lignum Vitae and Adams Keys. The occurrence of the butterfly is dependent on the native Torchwood (*Amyris elemifera*), its caterpillar food plant.

The South Miami population has been extinct for many years, and the Key Largo population is now strongly reduced due to commercial development there.

Bahama Swallowtail. This butterfly occurs in the Bahama Islands and in extreme South Florida. In Florida it may have occurred in the South Miami area where it is now extinct. In 1972 a colony of the butterfly was discovered on Elliot Key within the confines of Biscayne National Monument. Its required habitat is similar to that of the Schaus Swallowtail except that its caterpillar food plant is Key Lime (*Citrus aurantifolia*) and Sour Orange (*Citrus aurantium*).

2. *Overutilization for commercial sporting, scientific, or educational purposes.—Schaus Swallowtail.* There are reports that single specimens of this butterfly have been sold to amateur butterfly collectors for as much as $150. There are also reports that some zealous collectors have thoroughly searched its food plant for caterpillars so that specimens might be procured. Intensive searching of food plants for caterpillars is believed to be the most serious threat to all populations on keys in Biscayne National Monument. A proposed ferry service to these islands would allow amateur collectors ready access to these populations. Taking of the adult butterflies, however, is not considered as serious a threat, and no exportation to foreign countries is known.

Bahama Swallowtail. These butterflies are highly desired by collectors and their commercial value is considerable.

3. *Disease or predation.—Schaus Swallowtail.* Not applicable. *Bahama Swallowtail.* Not applicable.

4. *The inadequacy of existing regulatory mechanisms.—Schaus Swallowtail.* Although this species is Federally protected within

For color photos of *Papilio aristodemus ponceanus* and *P. andraemon bonhotei* see inside front and back covers.

Biscayne National Monument, it is not protected in other portions of its range.

Bahama Swallowtail. Not applicable. (The species occurs only in Biscayne National Monument, where it is federally protected.)

5. *Other natural or man-made factors affecting its continued existence.—Schaus Swallowtail.* In the past, hurricanes have been reported, at least temporarily, to have eliminated some populations of this species.

The areas from which the butterfly was eliminated were subsequently recolonized from adjoining populations. The smaller the range of this species becomes, however, the greater the risk that a single natural event (hurricane or freeze) could cause the species to become extinct.

Bahama Swallowtail. Although there are no previous reports of this species having been affected detrimentally by hurricanes, the potential does exist. The small range of the species makes it highly vulnerable to natural calamity.

These species are proposed as "Threatened" species rather than as "Endangered" species because major portions of their range are within Biscayne National Monument where they are protected by Federal law.

All prohibitions of section 9(a) of the Endangered Species Act of 1973 shall apply, with the exception of the following permitted act:

(1) The taking of adult Schaus Swallowtail (*Papilio aristodemus ponceanus*) on Key Largo for non-commercial purposes in compliance with State laws and regulations.

The part of Miller's April 23 reply that dealt with the two swallowtails is reproduced below. His communication also considered at some length 42 butterfly species which had been the subject of a notice published in the March 20, 1975, *Federal Register.* This had stated that the USDI "has evidence on hand to warrant review (of these species) to determine whether they should be proposed for listing as either endangered or threatened species." The segment of Miller's reply dealing with these 42 species is omitted from the following text (a table listing these species is shown on p. 18).

To Mr. Lynn A. Greenwalt, Director, U.S. Fish and Wildlife Service, U.S. Department of the Interior:

I wish to comment upon your proposed rule 50 CFR Part 17, as published in *Federal Register,* 40(78): p.17757 [April 22, 1975], and the "Review of Status: United States Butterflies", FR Doc. 75-7233, as published in *Federal Register*, 40(55): p. 12691 [March 20, 1975].

Several factors must be considered before placing insects (or other organisms, for that matter) on either the "Endangered" or the "Threatened" lists. As will be brought out later in this letter, I do not believe that many of these factors have been researched sufficiently to warrant the butterflies' placement on either list.

One consideration which must be made is whether or not organisms included on these lists are native species. This factor seems relatively elementary, but in several instances it has not been considered in the compilation of the lists. It is counterproductive to declare non-native species as "endangered" or as "threatened" at a time when we still do not know what species are found within the confines of the United States, either as natives or as strays. Placement of these exotic insects on the protected lists will simply discourage the reporting of other new records for the country at a time when we are just beginning to get a rudimentary idea of what occurs and has occurred here. Another fundamental consideration in this regard is that all species have portions of their ranges where conditions are marginal for survival; hence, they are rare in these peripheral areas: this is the condition in which vicariant populations find themselves in the vast majority of cases.

This factor brings the second fundamental consideration. Care must be taken to avoid designation of a particular organism as "threatened" or "endangered" on the basis of its tenuous hold in a specific locality. In FR Doc. 75-7253 there are several species listed solely on the basis of one or a few of many habitats being in such a critical state. It must be obvious that preservation of the entire gene-pool of an insect throughout a broad area is not only impossible, but may be completely unrealistic, or even undesirable.

A third criterion which must be considered is whether the species in question is confined to a very limited area. This is the opposite situation to that mentioned above, because if the entire range of the organism is restricted to a very small colony then it could be subjected to pressures which could involve its extirpation. Very small populations are subjected to many different environmental pressures which can lead to extermination, the least important of which could be over-collecting.

A factor which then must be considered is whether the habitat is being threatened or not. Most, if not all, organisms cannot be collected to extinction, but if their habitats are destroyed they *will* become extinct, *no matter what controls are placed upon collectors.* The real problem for most "endangered" or "threatened" species cannot be laid at the feet of collectors, no matter how zealous they may be, but are, rather, attributable to the destruction of their habitats by man or natural catastrophes. Federal lands already have the potential for protection by edict and without the necessity of attempting to declare species upon them "threatened" or "endangered," whether this decision is reached on the basis of facts or simply capriciously. It is to be hoped that such determinations will not adversely affect legitimate scientific research and will be administered in an even-handed manner.

It should be stated here also that extinction is a natural phenomenon, as well as a man-caused event. Not all organisms are "fit" (in a genetic sense) to compete with others and survive. Perhaps man is being a bit arrogant if he feels he can prevent such random extirpations, especially when the causes cannot be attributed to him. There are some poorly adapted organisms in the list in FR Doc. 75-7253 which cannot be expected to survive, chiefly because of the natural modification of the climate. There probably is nothing that can be done for such species, and calling attention to them may actually be doing them a disservice.

Destruction of the habitats, generally unknowingly and never with malice of forethought, by man's activities can be stopped, of course, in several ways, most of them contrary to the expressed goal of "free enterprise" espoused by the government and by most of the citizens of the United States. Government agencies can, naturally, stop all development of "endangered" habitats, but this is tantamount to seizure of the property without due compensation. A more honest, but still abhorrent, approach is to simply seize the property "in the public good" by local, state, or national agencies, an approach which usually leaves a discontented significant portion of the populace. Private or governmental bodies, acting together or singly, can purchase "endangered" habitats, but this can become economically unjustifiable for the preservation of a single species, especially an insect. Not too surprisingly, many of the species being considered for "Endangered" or "Threatened" status are found in areas of growing population and skyrocketing property values. Who can blame the property owner for accepting a developer's offer of many times what the government or the Nature Conservancy is willing and able to pay for his land? Certainly I cannot blame him, even though I should prefer to see the habitats preserved, but economic considerations being what they are, a property owner has no choice.

It is far easier, and certainly much more politically expedient, to merely place restrictions on the collecting of various species, but such controls will do *nothing* to preserve an insect population. What the controls will accomplish, however, is clandestine collecting activities in areas pinpointed for such collectors by federal edict and the concomitant mislabeling of specimens by such unscrupulous individuals. The regulations will also hamper meaningful scientific research, inasmuch as these researchers will be the ones who will assiduously observe the rules; the potential research by these scientists might give an idea of what factors control these populations and the *intelligent* ways by which they might be preserved. I am very much afraid that the imposition of these regulations will do nothing to preserve the species, inasmuch as the emphasis is on collecting rather than upon preservation of the habitats. The net effect of these rules will be a self-perpetuating bureaucracy which can accomplish none of its originally constituted goals, but which can look upon imposition of various regulations as a justification of its existence.

Now that I have discussed what I consider to be the cogent general considerations, I should like to make specific comments upon the status of the species included in the two lists, beginning with 50 CFR Part 17. With regard to the proposed "Threatened Status" of *Papilio aristodemus ponceanus* and *P. andraemon bonhotei,* I seriously question the advisability of placing either in this category, with different reasons for each species, as enumerated below.

P. aristodemus ponceanus is a rather common insect in southern Florida in some years and is exceedingly rare in others, perhaps as a result of drier or wetter winters in the range. Several colonies are known at present in Dade and Monroe counties, and all seem to be correlated with outside, natural conditions in their cyclic abundance. The observations leading to various statements about the "rarity" of this insect were taken during years of cyclic decline in the populations, without taking these cycles into account. The chief reason that this species has been considered rare and threatened with extinction was a 1940 article by Mrs. Florence Grimshawe that appeared in *Nature Magazine*. It is less well known that Mrs. Grimshawe was a professional Lepidoptera collector and dealer both before and after publication of her article, and the seriousness with which the article was viewed resulted in the inflated prices collectors were willing to pay *her* (virtually the only supplier of *ponceanus* at the time) for her specimens! Thus, she alone accounted for the fallacious idea of the rarity of the butterfly and for the commercial value placed upon it. Yet, the myth of the near-extinction of *ponceanus* has survived despite the careful work of such as Covell and Rawson, who stated ". . . *ponceanus* seems to be well established on at least two of the islands in the Biscayne National Monument. . . the Schaus Swallowtail seems safe from real or imagined threats of extinction. . ." This paper seems to have been ignored by those who are concerned with the "preservation" of this insect. Since the range of this butterfly lies partially within the confines of the Biscayne National Monument, it is obvious that it can be preserved without formal designation as "Threatened" by the simple expedient of controlling collecting and "development" on the keys of the monument. If anything short of natural disaster is likely to extirpate other colonies of this butterfly on nonfederal lands it will not be the casual collector of insects, but rather the bulldozing and "development" of the habitats in which it now flies. Should preservation of these other habitats be deemed necessary, the only logical way would be the purchase of them by governments or interested private parties. I would be unalterably opposed to the confiscation of such properties by local, state or federal governments.

It has been stated that commercial collecting and sale of this insect could act to endanger it. I question the validity of this conclusion, but even should it be deemed valid, there is a simple and reasonably inexpensive alternative to collecting restrictions. The butterfly is easily raised in captivity, and mass-rearing of even a few hundred individual specimens and offering them to collectors for a reasonably modest exchange could immediately "defuse" whatever commercial market may exist for this species. We have anticipated such a plan for a couple of years and feel that it can be done with a minimum of expense and a maximum of good to the species. Should restrictive practices become law, however, we must and will abandon future thought of this project, probably to the detriment of *ponceanus*.

The situation with *Papilio andraemon bonhotei* is quite different, and this species warrants "Threatened Status" even less than does ponceanus. This insect is presently known only from the confines of the Biscayne National Monument within the confines of the United States; therefore, there is no concern about preserving its habitat, assuming that the National Park Service does its job. Secondarily, but this should be a pivotal concern when considering a species for the "Endangered" or the "Threatened" lists, *bonhotei* is a vicariant species which probably never has become well established in this country.

BUTTERFLY SPECIES CURRENTLY UNDER REVIEW BY THE U.S. DEPARTMENT OF THE INTERIOR TO DETERMINE WHETHER THEY SHOULD BE PROPOSED FOR LISTING AS EITHER ENDANGERED OR THREATENED.

Scientific name	Common name	Where found
Parnassius clodius strohbeeni	Strohbeen's parnassian	California
Anthocharis cethura catalina	Catalina orange tip	Do.
Euchloe hyantis andrewsi	Andrews' marble	Do.
Eurema dina dina	Dina's yellow	Florida and Cuba
Euptychia mitchellii	Mitchell's satyr	Indiana, New Jersey and Michigan.
Ceryonis meadi alamosa	Mead's satyr	Colorado.
Oenius chryxus valerata	Chryxus Arctic	Washington
Speyeria nokomis nokomis	Great Basin silverspot	Utah.
Speyeria nokomis apacheana	Apache silverspot	California and Nevada.
Speyeria nokomis nitocris	Mountain silverspot	Arizona
Speyeria nokomis caerulescens	Blue silverspot	Arizona, New Mexico and Mexico.
Speyeria zerene myrtleae	Myrtle's silverspot	California.
Speyeria zerene hippolyta		Oregon
Speyeria adiaste adiaste	Unsilvered fritillary	California.
Speyeria adiaste clemencei	Clemence's fritillary	Do.
Speyeria adiaste atossa	Atossa fritillary	Do.
Speyeria egleis tehachapina	Tehachapi Mountain silverspot	Do.
Euphydryas editha wrighti	Wright's checkerspot	Do.
Euphydryas editha monoensis	Mono checkerspot	Do.
Poladryas minuta	Minute checkerspot	Texas.
Limenitis archippus obsoletus	Obsolete viceroy	Arizona, California, and Nevada.
Eumaeus atala florida	Atala	Florida and Cuba
Callophrys mossi bayensis	San Bruno elfin	California.
Callophrys mossi doudoroffi	Doudoroff's elfin	Do.
Callophrys mossi windi	Wind's elfin	Do
Callophrys lanoraieensis	Bog elfin	Maine and Canada
Callophrys hesseli	Hessel's hairstreak	Connecticut, Delaware, Maryland, New Jersey, New York, North Carolina and Virginia.
Vaga blackburni	Hawaiian hairstreak	Hawaii.
Lycaena arota nubila	Clouded tailed copper	California
Lycaeides melissa samuelis	Karner blue	New York and Canada
Lycaeides argyrognomon lotis	Lotis blue	California.
Icaricia icarioides missionensis	Mission blue	Do
Icaricia icarioides pheres	Pheres blue	Do
Icaricia icarioides moroensis	Moro Bay blue	Do.
Philotes enoptes smithi	Smith's blue	Do.
Philotes battoides (El Segundo Population).		
Apodemia mormo langei	Lange's metalmark	Do.
Stallingsia maculosus	Maculated manfreda skipper	Texas
Megathymus coloradensis kendalli	Kendall's yucca skipper	Do
Hesperia dakotae	Dakota skipper	Iowa, Minnesota, South Dakota, and Canada
Problema bulenta	Rare skipper	Georgia, North Carolina, South Carolina, and Virginia.
Panoquina panoquinoides errans	Salt marsh skipper	California and Mexico

(Continued on p. 22)

"Getaway" Weekend for Museum Members

Devil's Lake, Wisconsin

A weekend field trip, sponsored by Field Museum, will leave the Museum at 8:00 Saturday morning, Sept. 27, and return Sunday, Sept. 28, at about 7:00 in the evening.

Enjoy the beauty of Wisconsin's Baraboo Range with its fall colors and invigorating crisp weather—ideal for hiking.

Dr. Matthew Nitecki, curator, fossil invertebrates—who has led many other Field Museum tours—will conduct a geology field trip through the range and along the shores and hinterland of beautiful Devil's Lake.

The Baraboo Range is of special interest as a *monadnock* —what is left of an ancient mountain range and which now stands out above the younger rocks and sediments. The range consists of quartzite—more than one billion years old—which, although compressed in places into vertical folds, retains the original sedimentary structures. The mountains were further modified by glaciers, forming the lake and the picturesque glens, and changing the course of rivers.

The cost of this educational weekend is $50.00 per person, and includes all expenses of transportation on a charter bus and overnight accommodations in a first class resort motel. (Price is based on double occupancy, with twin beds. An extra fee will be charged for single facilities.) The fee also includes all meals and gratuities, except personal extras such as alcoholic beverages and special food service. Saturday evening will be free for you to enjoy the motel's swimming pool or other recreational facilities.

Hiking clothes are strongly recommended for the scheduled hikes. The trip is not suitable for children, but young people interested in natural history are welcome.

For further details write or call Dorothy Roder, Field Museum 922-9410, ext 219.

Field Museum Geology Field Trip
September 27-28, 1975

I wish _____ reservations for the Baraboo Range Field Trip.
(how many)

Name _____

Address _____

City _____ State _____ Zip _____

Telephone: _____

Amount enclosed _____
(make checks payable to Field Museum)

Sugaring for Moths

A TURN-OF-THE-CENTURY LEPIDOPTERIST STALKS MOTHS WITH SUGAR, BEER, AND RUM!

by W. J. Holland

The day has been hot and sultry. The sun has set behind great banks of clouds which are piled up on the northwestern horizon. Now that the light is beginning to fade, the great masses of cumulus, which are slowly gathering and rising higher toward the zenith, are lit up by pale flashes of sheet-lightning. As yet the storm is too far off to permit us to hear the boom of the thunder, but about ten or eleven o'clock to-night we shall probably experience all the splendor of a dashing thundershower.

Along the fringe of woodland which skirts the back pastures is a path which we long have known. Here stand long ranks of ancient beeches; sugar maples, which in fall are glorious in robes of yellow and scarlet; ash trees, the tall gray trunks of which carry skyward huge masses of light pinnated foliage; walnuts and butternuts, oaks, and tulip-poplars. On either side of the path in luxuriant profusion are saplings, sprung from the monarchs of the forest, young elm trees planted by the winds, broad-leaved papaws, round-topped hawthorns, viburnums, spreading dogwoods, and here and there in moist places clumps of willows. Where the path runs down by the creek, sycamores spread their gaunt white branches toward the sky, and drink moisture from the shallow reaches of the stream, in which duckweed, arrow-weed, and sweet pond-lilies bloom.

The woodland is the haunt of many a joyous thing, which frequents the glades and hovers over the flowers. To-night the lightning in the air, the suggestion of a coming storm which lurks in the atmosphere, will send a thrill through all the swarms, which have been hidden through the day on moss-grown trunks, or among the leaves, and they will rise, as the dusk gathers, in troops about the pathway. It is just the night upon which to take a collecting trip, resorting to the well-known method of "sugaring."

Here we have a bucket and a clean whitewash brush. We have put into the bucket four pounds of cheap sugar. Now we will pour in a bottle of stale beer and a little rum. We have stirred the mixture well. In our pockets are our cyanide jars. Here are the dark lanterns. Before the darkness falls, while yet there is light enough to see our way along the path, we will pass from tree to tree and apply the brush charged with the sweet semi-intoxicating mixture to the trunks of the trees.

The task is accomplished! Forty trees and ten stumps have been baptized with sugar-sweetened beer. Let us wash our sticky fingers in the brook and dry them with our handkerchiefs. Let us sit down on the grass beneath this tree and puff a good Havana. It is growing darker. The bats are circling overhead. A screech-owl is uttering a plaintive lament perhaps mourning the absence of the moon, which to-night will not appear. The frogs are croaking in the pond. The fireflies soar upward and flash in sparkling multitudes where the grass grows rank near the water.

Now let us light our lamps and put a drop or two of chloroform into our cyanide jars, just enough to slightly dampen the paper which holds the lumps of cyanide in place. We will retrace our steps along the path and visit each moistened spot upon the tree-trunks.

Here is the last tree which we sugared. There in the light of the lantern we see the shining drops of our mixture clinging to the mosses and slowly trickling downward toward the ground. Turn the light of the lantern full upon the spot, advancing cautiously, so as not to break the dry twigs under foot or rustle the leaves. Ha! Thus far nothing but the black ants which tenant the hollows of the gnarled old tree appear to have recognized the offering which we have made. But they are regaling themselves in swarms about the spot. Look at them! Scores of them, hundreds of them are congregating about the place, and seem to be drinking with as much enjoyment as a company of Germans on a picnic in the wilds of Hoboken.

Let us stealthily approach the next tree. It is a beech. What is there? Oho! my beauty! Just above the moistened

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W.J. Holland's The Butterfly Book *(1898) and* The Moth Book *(1903) were for many years the chief reference works for amateur lepidopterists. The latter work, from which "Sugaring for Moths" is reproduced, is again available, under the imprint of Dover Publications.*

patch upon the bark is a great *Catocala*. The gray upper wings are spread, revealing the lower wings gloriously banded with black and crimson. In the yellow light of the lantern the wings appear even more brilliant than they do in sunlight. How the eyes glow like spots of fire! The moth is wary. He has just alighted; he has not yet drunk deep. Move cautiously! Keep the light of the lantern steadily upon him. Uncover your poisoning jar. Approach. Hold the jar just a little under the moth, for he will drop downward on the first rush to get away. Clap the jar over him! There! you have done it! You have him securely. He flutters for a moment, but the chloroform acts quickly and the flutterings cease. Put that jar into one pocket and take out another. Now let us go to the next tree. It is an old walnut. The trunk is rough, seamed, and full of knotted excrescences. See what a company has gathered! There are a dozen moths, large and small, busily at work tippling. Begin with those which are nearest to the ground. When I was young my grandfather taught me that in shooting wild turkeys resting in a tree, it is always best to shoot the lowest fowl first, and then the next. If you shoot the gobbler which perches highest, as he comes tumbling down through the flock, he will startle them all, and they will fly away together; but if you take those which are roosting well down among the branches, those above will simply raise their heads and stare about for a moment to find out the source of their peril, and you can bag three or four before the rest make up their minds to fly. I follow the same plan with my moths, unless, perchance, the topmost moth is some unusual rarity, worth all that suck the sweets below him.

Bravo! You have learned the lesson well. You succeeded admirably in bottling those *Taraches* which were sucking the moisture at the lower edge of the sweetened patch. There above them is a fine specimen of *Strenoloma lunilinea*. Aha! You have him. Now take that *Catocala*. It is *amasia*, a charming little species. Above him is a specimen of *cara*, one of the largest and most superb of the genus. Well done! You have him, too. Now wait a moment! Have your captives ceased their struggles in your jar? Yes; they seem to be thoroughly stunned. Transfer them to the other jar for the cyanide to do its work. Look at your lantern. Is the wick trimmed? Come on then.

Let us go to the next tree. This is an ash. The moist spot shows faintly upon the silvery-gray bark of the tree. Look sharply! Here below are a few *Geometers* daintily sipping the sweets. There is a little *Eustixis pupula*, with its silvery-white wings dotted with points of black. There is a specimen of *Harrisimemna*, the one with the coppery-brown spots on the fore wings. A good catch!

Stop! Hold still! Ha! I thought he would alight. That is *Catocala coccinata* —a fine moth—not overly common, and the specimen is perfect.

Well, let us try another tree. Here they are holding a general assembly. Look! See them fairly swarming about the spot. A dozen have found good places; two or three are fluttering about trying to alight. The ants have found the place as well as the moths. They are squabbling with each other. The moths do not like the ants. I do not blame them. I would not care to sit down at a banquet and have ants crawling all over the repast. There is a specimen of *Catocala relicta*, the hind wings white, banded with black. How beautiful simple colors are when set in sharp contrast and arranged in graceful lines! There is a specimen of *Catocala neogama*, which was originally described by Abbot from Georgia. It is not uncommon. There is a good *Mamestra*, and there *Pyrophila pyramidoides*. The latter is a common species; we shall find scores of them before we get through. Do not bother with those specimens of *Agrotis Ypsilon*; there are choicer things to be had. It is a waste of time to take them to-night. Let them drink themselves drunk, when the flying squirrels will come and catch them. Do you see that flying squirrel there peeping around the trunk of the tree? Flying squirrels eat insects. I have seen them do it at night, and they have robbed me of many a fine specimen.

Off now to the next tree!

And so we go from tree to tree. The lightning in the west grows more vivid. Hark! I hear the thunder. It is half-past nine. The storm will be here by ten. The leaves are beginning to rustle in the tree-tops. The first pulse of the tornado is beginning to be felt. Now the wind is rising. Boom! Boom! The storm is drawing nearer. We are on our second round and are coming up the path near the pasture-gate. Our collecting jars are full. We have taken more than a hundred specimens representing thirty species. Not a bad night's work. Hurry up! Here are the draw-bars. Are you through? Put out the light in your lantern. Come quickly after me. I know the path. Here is the back garden gate. It is beginning to rain. We shall have to run if we wish to avoid a wetting. Ah! here are the steps of the veranda. Come up!

My! what a flash and a crash that was! Look back and see how the big trees are bowing their heads as the wind reaches them, and the lightning silhouettes them against the gray veil of the rain. We may be glad we are out of the storm, with a good roof overhead. To-morrow morning the sun will rise bright and clear, and we shall have work enough to fill all the morning hours in setting the captures we have made. Good-night! □

(Con't from p. 18)

The metropolis of this insect is the Bahama Islands, and in all probability this butterfly has been introduced into this country from that reservoir many times in the past, flourished briefly, then died out for one reason or another only to be reintroduced into the United States at a later date. The most recent information that I have is that *bonhotei* may no longer be present on Elliot Key. Before the turn of this century three vicariant swallowtails were reported from southmost Florida which did not appear in later collections: *P. andraemon bonhotei, Eurytides celadon* and *Battus devilliers*. The last two are Cuban insects, *bonhotei* is Bahaman, and for several years doubt was expressed in the literature as to the authenticity of the earlier records. It is only in recent years that *bonhotei* has reappeared in Florida collections; the other two still have not. Probably all three swallowtails were present in small, marginal populations during the last part of the 19th Century but were extirpated in the great freeze of 1899 which extended below freezing temperatures into the northern keys; statistically such freezes are inevitable in the future. Accordingly, if *bonhotei* is listed as a "Threatened" species, *celadon* and *devilliers* should be, too, but it would be a pity to prevent collecting these insects when their collection could confirm some old records which have received some possibly unwarranted criticism in recent years. . . .

. . .In general, butterflies are not "Threatened," but habitats are. The situation for insects is different from that of large mammals, birds, etc., but the habitat problems are similar for all. Insects have a much briefer generation time, the flight period of the imagines is much shorter and populations higher for unit of area.

The root cause of most butterfly extirpation in the past and whatever threats there are toward it now is destruction of the habitat The means for preservation become obvious when this is realized, the acquisition of "Threatened" habitats. Such habitats should be established, however, for more than single species, at least whenever possible. This results in a lower per species cost for preservation and is easier to justify to funding agencies, etc. . . .

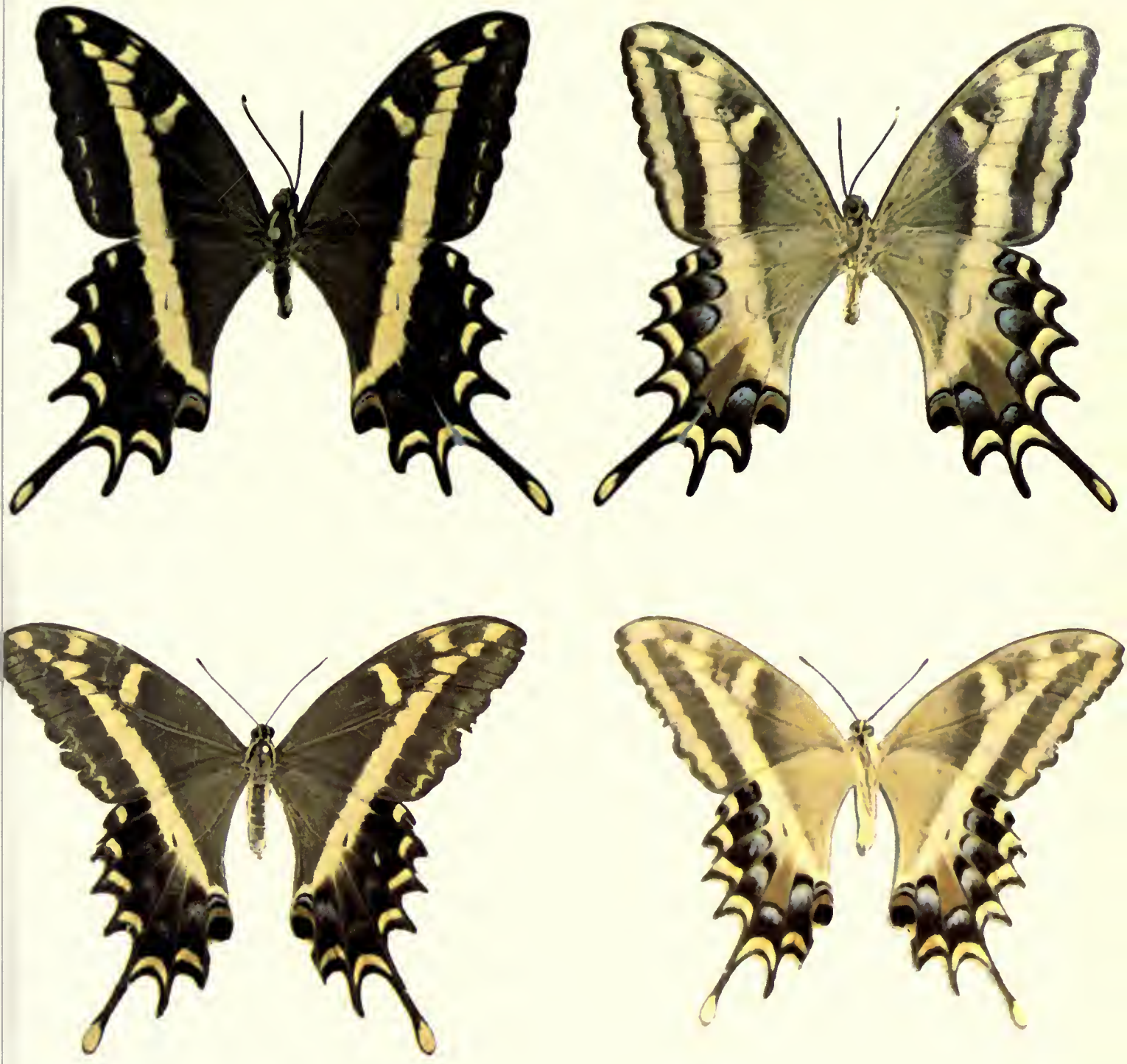
Strangely enough, if the habitats were preserved there would be no need to control casual insect collecting. The collectors are being used as scapegoats for actions that are not their fault. I can state categorically, and will challenge anyone to prove me wrong, that *no insect has ever been extirpated by collectors*—many have been by indiscriminate habitat destruction. The situation is different for other groups of animals, most of which have a lower density per unit of habitat, and certainly for plants, since they cannot escape. One begins to feel that since there are so few butterfly collectors in the United States and since most of them are not politically active, that they are "safe" targets for special restrictive legislation and regulation. The fact that butterfly collectors long have been considered the "lunatic fringe" of society (note the many cartoons to this effect) no doubt makes them popular targets, but those of us in the science have long attempted to counteract this image. It might also be stressed that in entomology, as in few other sciences, the knowledgable amateur has made great and significant contributions. . . .

The entire problem of "preservation" is one inextricably tied to emotion. The "Sierra Club syndrome" of "when in doubt, preserve" without regard to or feeling of necessity for real knowledge on the organism involved is a popular one and one which receives headlines. Misguided activities, no matter how well intentioned, are bound to fail when not based on research results. We simply do not know enough about insect population structures, nor do we know enough about their ranges. The only way we shall ever find these things out will be by collection, not only of specimens, but also of data. Then, and only then, will we know enough to make intelligent decisions about the future of the organisms involved. In the meantime, habitats should be preserved and responsible research encouraged (and possibly even supported) to determine what action needs to be taken.

Precipitous action may please a few proponents of greater and greater controls, but it will do nothing for the insects. I have the serious feeling that the proposed controls have been poorly researched and perhaps hastily contrived as a justification for a bureaucracy. I wish I could feel otherwise, but I simply lack the faith, apparently, to deny my own analyses.

—*Lee D. Miller*

Lee D. Miller, curator of the Allyn Museum of Entomology, Sarasota, Fla.



Papilio andraemon bonhotei. Top left and right: male, upper and lower surfaces, respectively; bottom left and right: female, upper and lower surfaces. Photos courtesy Allyn Museum of Entomology, Sarasota, Fla. See p. 15.

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SEPTEMBER at Field Museum

SPECIAL EXHIBIT OPENS SEPTEMBER 15

"BEAUTY IN DETAIL: ILLUSTRATIONS BY ARTISTS FROM THE ROYAL BOTANIC GARDENS, KEW, ENGLAND" includes 123 plant illustrations ranging from mushrooms to orchids. The illustrations are the work of 39 staff members at Kew during a span of 200 years (mid-1700s to present).

Pen-and-ink and watercolor are the dominant media. Hand-colored lithographs and several etchings of Kew Gardens are also included. Three-dimensional plant models from the Field Museum's outstanding collection add their own form of illustration. The Garden Club of Lake Forest is supplying fresh flowers to further enhance the beauty of the exhibit. Hall 9.

PROGRAMS

Continuing:

THE ANCIENT ART OF WEAVING, demonstrated by members of the North Shore Weavers' Guild on a two-harness, handcrafted Mexican floor loom. Demonstrations every Monday, Wednesday, and Friday from 10:30 to 11:30 a.m. and from noon to 1:00 p.m. On Mondays, September 1 and 15, the demonstrations include spinning. South Lounge, second floor.

SATURDAY DISCOVERY PROGRAMS, consisting of tours, demonstrations, and participatory activities, are offered continuously from 11:00 a.m. to 3:00 p.m. Topics vary, but often include an ancient Egyptian tour, ideas about prehistoric man, live reptiles, Northwest Coast art, and the world of animals. For location details, inquire at Museum entrances.

FALL JOURNEY FOR CHILDREN

"PLANTS THAT GROW ON OTHER PLANTS," a free, self-guided tour focuses on the museum's botany halls. All children who can read and write are invited to participate. Journey sheets in English and Spanish are available at the information booth. Bring pen or pencil.

RAY A. KROC ENVIRONMENTAL EDUCATION PROGRAM

ADVANCE REGISTRATION is required for participation in the autumn series, which provides an overview of the role of natural ecosystems in the economy of life. A $5 per-person fee (nonrefundable) covers lunch and transportation. For further information call Lorain Stephens, 922-9410, ext. 360 or 361.

Sept. 10: **"Illinois Beach State Park."** Learn about the value of marsh and lakeshore, and meet some interesting inhabitants of these aquatic communities.

Sept. 14: repeat of above.

Sept. 17: **"Indiana Dunes."** Hike the dunes and discover a unique ecosystem that is far more than a recreational facility.

Sept. 21: **"Pit 11,"** for ages 12, 13, and 14. Take a trip to a strip mine to find fossil evidence of an ancient coal forest.

ANOTHER KROC PROGRAM IS "INTRODUCTION TO COMMUNITY ECOLOGY," A COURSE FOR TEACHERS.

Fee: $22 per person. Graduate credit is available for an additional fee of $74 per person. The course, consisting of four field trips and a museum workshop, will explore communities reflecting both urban and natural ecology. Emphasis is on teaching techniques. Meets Saturdays, Sept. 13, 20, 27; Oct. 4 and 11. For further information call Jim Bland, 922-9410, ext. 203.

VOLUNTEER OPPORTUNITIES

OPENINGS ARE STILL AVAILABLE for those interested in Field Museum's volunteer training course. Please call 922-9410, ext. 247 for an appointment.

MEETINGS

Sept. 2, 7:30 p.m.	Kennicott Club
Sept. 9, 7:00 p.m.	Chicago Nature Camera Club
Sept. 10, 7:00 p.m.	Chicago Ornithological Society
7:30 p.m.	Windy City Grotto, National Speleological Society
Sept. 11, 8:00 p.m.	Chicago Mountaineering Club
Sept. 14, 2:00 p.m.	Chicago Shell Club
Sept. 16, 7:30 p.m.	Chicago Audubon Society

COMING IN OCTOBER

MAN IN HIS ENVIRONMENT LECTURE SERIES: "MAN'S ONE WORLD." A film-lecture series focusing on the impact of ecological disturbance upon a number of traditional cultures. Anthropologists will discuss the films and answer questions about these pressures and changes.

Oct. 3, 4:	*The Tribe that Hides from Man*
Oct. 10, 11:	*The Turtle People*
Oct. 17, 18:	*The Last Tribes of Mindanao*
Oct. 24, 25:	*The Ice People*
Oct. 31, Nov. 1:	*Man of the Serengeti*
Nov. 8, 9:	*The Village*
Nov. 14, 15:	*Ishi in Two Worlds*
Nov. 21, 22:	*Sky Chief*

SEPTEMBER HOURS

The museum opens daily at 9:00 a.m. and closes at 5:00 p.m. Saturday through Thursdays. Fridays to 9:00 p.m. Food service areas open weekdays 11:00 a.m. to 3:00 p.m., weekends to 4:00 p.m.

The museum library is open 9:00 a.m. to 4:00 p.m. Monday through Friday. Please obtain pass at reception desk, first floor north.

Museum Telephone: 922-9410

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Interdunal lagoon in old age, Gary, Indiana. Photo by Charles F. Davis, of Oak Park, Illinois. Mr. Davis has taught nature photography at Field Museum.

PHOTO CREDITS

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BUYING TIME

In The Energy Crisis

by Edward Olsen

Waste not, want not, is the maxim I would teach.
Let your watchword be dispatch, and practice what you preach:
Do not let your chances like sunbeams pass you by,
For you never miss the water till the well runs dry.
—*Rowland Howard*

One hundred and fifty years ago the typical American heated his home and cooked his food with heat energy from burning wood. The wood had to be cut by hand, transported by horse-drawn wagon, and manhandled into sheds or piles to keep it more or less dry through an entire winter. Obtaining his heat energy requirements was a sufficiently impressive chore that it was used in sparing fashion, a part of a whole life-style and ethic that came to be called "Yankee conservatism."

This ethic never really died, though it has certainly waned. It survived into the early part of this century in rural areas, and the Great Depression of the 1930s forced it upon even the most cavalier city dweller. America moved from using wood to using coal, natural gas, and oil products by the turn of the century. It is interesting that John D. Rockefeller, with his Standard Oil Company, accumulated his fabulous millions before 1900, when the automobile was still an experimental novelty. Most of his oil was sold for lighting and heating purposes.

Gas and oil have the nice properties of being easy to handle and transport. When they occurred in abundance the forces of a free economy market made them less expensive, and less impressive upon the average person's mind than the hard-won pile of wood in the woodshed of his grandfather. Thus, we have evolved into a nation of energy consumers, few of whom concern ourselves with the conservation of that energy. It is the exceptional American today who turns off a light bulb (which operates at less than 5 percent efficiency) when he leaves a room unoccupied for a period of time.

We are currently dependent upon petroleum products that are dwindling domestically, and we find ourselves in the difficult position of having to rely upon imported sources. This reliance has negative effects on our economy (balance of payments), political abilities, and national security. We do have some additional domestic petroleum resources, very large coal resources, and an inventive technology that can tap novel sources of energy; however, in each case we face what is called "lead time." It takes about seven years from the time a new oil field is discovered to start it into production on a commercial basis. Depending on the circumstances, a new coal mine can take more than five years to get into production. New energy sources, such as solar, wind, tidal, geothermal (wet and dry), water-temperature-gradient systems, fuel cells, atomic fusion, and so on will take decades to become major factors in the energy-supply picture. Thus, we are faced with a problem of buying time until additional sources can be developed. The only way to do this is to stretch what we have now and return to the old conservation ethic that was a part of our national life style when this country was young.

Energy Conservation

At present we use over 25 percent of all our energy in commercial and residential heating (including water heating), cooking, refrigeration, and air-conditioning. Great savings of energy can be made in this sector. Insulation of walls, ceilings, and floors, and the

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Edward Olsen is curator of mineralogy.

addition of window and door weatherstripping and storm windows, would save 42 percent of the energy used in heating alone. In terms of our national energy total this comes to a saving of about 7.5 percent or over 1.4 quadrillion calories—the equivalent of about one billion barrels of oil each year.

Most space-heating furnaces today, whether burning oil, gas, or coal, lose about one fourth of their heat up the chimney *if* they are well maintained. Most are not, however, and they lose 50 to 65 percent of their heat to the outside. Although an electric heater is close to 100 percent efficient at the point where it is operating, when electrical line transmission losses are considered, and the inefficiencies inherent in present electrical generating facilities, the electric space heater comes out only about 30 percent efficient.

Thus, great conservation can be attained by insulating older buildings as much as possible (and it is, of course, impossible to insulate them completely without dismantling and rebuilding them), and requiring that new construction be fully insulated. By tax incentives, individuals and companies could be encouraged to maintain their heating equipment so that their best efficiencies can be achieved.

In the area of refrigeration, it is known that self-defrosting refrigerators use 50 percent more electricity to operate than the kind that require manual defrosting. On the other hand, the energy lost in manually shutting down a refrigerator and then, later, running it excessively to achieve cooling temperatures again, could balance out the difference in apparent operating costs if the manual refrigerator requires defrosting several times each year. This depends on the simple matter of how well the door seals are maintained and on whether the door is left open for long periods of time during meal preparation. Leaving the door open, especially in humid summer months, can cause frost to build up rapidly, lower the efficiency of the food-cooling unit, and require more frequent defrostings. It comes thus to the matter of developing more cautious personal habits.

In this regard, there is the erroneous notion abroad, that a light bulb has its life shortened if it is repeatedly turned off and on, and that it is cheaper, in the long run, to leave it on if one is going out of a room for moderate periods of time. This is not true. The old habit (of depression years) of turning bulbs off when leaving a room, even for a few minutes, saves energy in the long run. On the other hand, the lifetime of a fluorescent tube can be shortened by repeated turnings off and on. A fluorescent tube uses about one fourth as much energy to operate per unit of light as does a bulb. Deciding whether or not to turn off a light should be determined by how long one plans to be out of a room.

Home gas ovens and stoves, gas-fired furnaces, gas-fired water heaters, and gas clothes driers, all use significant amounts of natural gas just to keep their pilot lights burning. Gradually these might be phased out in favor of units that use electronic spark ignition devices. By the same token, gas lamps that serve to merely decorate the front lawns of residences will have to go.

The current trend in large cities, such as Chicago and New York, is to build gigantic office buildings with "internal climates." These have smoky glass windows to diminish the sun's light, air-conditioning, heating and humidity control, and uniform lighting. There is, then, a certain amount of light per square yard, whether or not persons are working in that square yard, as opposed to the old system of individual desk lamps. In fine weather there is no way to open a window, nor any way to let in natural light. Thus, a building such as the World Trade Center in New York City uses more energy than the entire city of Schenectady, New York, population 100,000!

TABLE 1
Energy Consumption for Passenger Transportation*

Means of Transportation	Calories Per Passenger Mile	
	Urban Travel	Intercity Travel
Bicycle	50	
Walking	75	
Bus	925	400
Railroad		725
Automobile	2,025	850
Airplane		2,100

*After E. Hirst, Oak Ridge National Laboratory

Transportation, especially personal transportation, is a big factor in energy conservation. It takes, for example, 27 times more energy to drive to a store to buy a loaf of bread than it does to walk there and, surprisingly, 40 times more energy than to bicycle there! Table 1 shows some comparative values of calories per passenger mile. For those who wish to lose weight, walking is a far better deal than biking. Suburban communities and their shopping centers, that have built up over the past few decades, are based on the automobile. The ability to drive, inexpensively, to shop is the reason they can exist. As fuel prices increase, suburbanities will have to consider more efficient shopping practices, that is, waiting to shop until they get a long list of items to purchase, perhaps car-pooling with neighbors, and encouraging suburban bus routes. In addition, the average American car gets only about 12 miles per gallon, whereas the average European car gets about twice that mileage. The trend to more efficient cars has started in the United States and will certainly continue. Chrysler Corporation has already announced that it intends to phase out all of its full-size autos and produce only compact models.

In both private and commercial sectors the use of air-conditioning has increased enormously over the past decade. The efficiency of air-conditioning units varies widely from as little as 1.2 calories of cooling (*i.e.*, heat removed) for each watt of electricity used per hour, to as much as 4.1 calories. This is about a 340 percent difference!

This large difference involves several factors; however, it is clear that the average efficiency of such units will have to increase toward the higher number of calories removed. It is estimated that if all home window air-conditioning units could be upgraded to about 2.5 calories of cooling per watt of electricity for each hour of operation, it would total up to a saving of 13.6 trillion calories per year in the United States.

Further, more careful use could be made of air-conditioning units. In private homes the use of attic fans can diminish heat build-up during hot summer days and reduce the need for air-conditioning. As simple a measure as having a few deciduous trees shading a house roof in the summer can make a big difference, as the dwellers of homes in the Old South learned a long time ago. Also, these trees lose their leaves in winter, which allows the winter sun to warm the roof, reducing some of the heating needs at those times.

In housing, there has been a dramatic rise in the sale of premanufactured homes—mobile homes and similar prefabricated units. About 25 percent of all new housing in the United States consists of mobile homes. These are thin-walled and usually poorly insulated. They are high users of energy, winter and summer. Obviously, stricter standards are going to have to be applied to the construction of such homes.

Industry is likely to respond to energy shortages more rapidly than individuals. Industry consumes about 40 percent of the energy used in the United States. For example, between 1960 and 1968 the energy needed to produce a ton of steel went from 7.5 million calories to 6.5 million calories, a drop of 13 percent. Much of this was due to increased efficiency of blast furnaces. New furnace designs are expected to effect even more dramatic reductions.

In the electrical-generating utilities, the efficiency of converting coal (in coal-fired generators) to electricity was only 5 percent in 1900. That is, 95 percent of the energy of the burning coal was lost in the process. The current efficiency is about 38 percent, and likely to improve. Most present nuclear power plants (light water reactors) produce electricity at about 31 percent efficiency. By innovations in this area, this can increase to about 50-60 percent.

Many industries are currently looking into systems to recover wasted heat, to recycle it, and increase their overall efficiency. For example, if a company uses diesel electrical generators, present practice is to vent the engine heat to the outside. This heat can be used to heat water or ducted air for their own space heating needs. Similarly, companies that require steam for a process (as in paper-making) could use the waste steam to run electrical generators to provide for their own electrical needs and, in some cases, have enough to sell to adjacent industries. Such systems are called *cogeneration systems*. They are being examined by a number of large industries to cut fuel costs and conserve energy.

TABLE 2
Energy Consumption for Freight Transportation*

Means of Transportation	Calories per Ton Mile
Pipeline	112
Railroad	168
Ships, barges, etc.	170
Truck	950
Airplane	10,500

*After E. Hirst, Oak Ridge National Laboratory

Incentives for Conservation

How we came to be a nation that forgot its Yankee conservative ethic is a complicated history of personal, commercial, industrial, and governmental practices. For example, because the government has subsidized road-building and airports, the public has responded by using these inherently inefficient means of transportation. Such trends will have to be reversed. Individuals, as well as industry, respond to increased prices rapidly. Tax incentives to promote sales of smaller, more efficient automobiles are clearly needed. Similarly, tax and interest rate incentives can promote the better insulation of new and old housing. Special, low natural gas and electrical rates by utilities to large users must be reviewed and new practices established depending on the nature of the use. Federal railroad regulations, many dating back 100 years, hamstring railroad companies and limit their ability to compete with other forms of transportation and cargo hauling—and even with themselves. In many other industries, accelerated depreciation allowances would promote the installation of new, more efficient equipment.

A strong energy conservation program by government and industry is clearly the only way we can buy time to the point where domestic energy production and consumption balance, and permit a modest annual growth. Volunteerism will not be enough.

In the private sector we are, each of us, going to have to increase activities that do not require much energy, especially petroleum. Long, cross-country trips in motor homes that get less than 10 miles per gallon will have to be replaced with excursions using public transportation—something Europeans learned long ago. Further, such low energy consumptive activities as handicrafts and arts, volunteer programs to help the aged, the young, and the sick; teaching, and involvement in political and public affairs, will all be avenues for individuals, rather than the more energy-consumptive free-time activities of the present. Energy conservation will have many personal repercussions. We may even get to know our neighbors again—another Yankee tradition revisited. □

A TIBETAN BUDDHIST SAINT

Field Museum's Padmasambhava Painting from Tachienlu

Berthold Laufer, photographed in China during his 1908-10 expedition.

By Bennet Bronson

The superb scroll painting, or *thanka,* shown opposite, now hangs in the northernmost case of Hall 32 on the second floor of Field Museum. It was acquired for the Museum in May, 1909, by the late Berthold Laufer (curator of the Department of Anthropology 1915-34) during his 1908-10 expedition to Tibet and China, and was found at the town of Tachienlu, or K'ang-tung, situated on the ethnic border between Chinese- and Tibetan-inhabited lands in Central Western China.

Laufer himself did not seem to have been greatly interested in Tachienlu, regarding it as a mere jumping-off point for his projected travels into the Tibet interior. However, the town had many Tibetan residents and so Laufer was able to do some collecting while waiting impatiently for red tape to be cleared and his caravan organized. With the help of a friendly missionary, he had the objects packed and shipped off on the long route by which they would eventually reach Chicago. Then he forgot them. His letters and later writings show no awareness that among his casually collected Tachienlu acquisitions was one of the finest Tibetan paintings ever brought to the United States.

It is executed in gold on a red ground, its details showing an astonishing delicacy and skill in draftsmanship. Its 18th-century maker, anonymous like most Tibetan artists, was a great master of Tibetan techniques of light-on-dark rendering. Notice, for instance, how powerfully the central subject is projected forward from the surrounding scenes.

This central subject represents not a god, but a historical person, the great teacher Padmasambhava, or Rinpoche, said to have been the first to carry the Buddhist religion northward from China into the mountains of Tibet. The background depicts events in Padmasambhava's life that are well known to every Tibetan—his teachings, blessings, and struggles against the demons whose worshippers held sole control over Tibet before his coming. The central figure is the saint in an attitude of meditative compassion, holding the symbolic objects by which he is recognized in Tibetan iconography, a thunderbolt in his right hand, a skull cup in his left hand, and a sacred staff behind him.

The purity and precision of the artist's work make the painting one of the most approachable of the Tibetan art objects in the Museum's collection. We may quite properly admire it for its esthetic qualities. But we should not forget that the painting was not originally meant as "art" as westerners understand the word. Partly it was meant to show off the wealth and sanctity of the monastery that first commissioned it. And partly it was designed as a psychological tool, contemplation of which would produce the psychic state necessary for a particular sort of meditation. The man who made it might well have denied that the painting was important for its beauty. He might even have denied that it was more beautiful than any other object in the world. But he would have maintained that it had profound importance nonetheless, as a memorial to a teacher more revered than any teacher can be in our society, and as a mental aid to eventual enlightenment. □

Bennet Bronson is assistant curator, Asiatic archaeology and ethnology.

LOWER TETRAPODS OF 1/4 BILLION YEARS AGO

Smaller than Dinosaurs, but Equally Interesting

by John Bolt

Dinosaurs are popular with paleontologists as well as with the public. It would be natural, then, to assume that a large natural history museum such as Field Museum has many dinosaur specimens in addition to those on display, and that the curator of fossil reptiles (and amphibians) does research on dinosaurs. In fact, interesting as dinosaurs are, I do not do research on them. This would be difficult in any case, since (again contrary to expectations) Field Museum has few dinosaurs other than those on display, and dinosaur specimens can hardly be borrowed from other institutions *via* parcel post. This dearth of dinosaurs is compensated by the excellence of the collection in other areas.

Most large natural history museums have a collection of fossil vertebrates, usually including lower tetrapods (reptiles and amphibians). Within the seemingly narrow limits implied by "fossil lower tetrapods," even very good collections of various museums may differ in emphasis. For instance, a strong point in Field Museum's collection is the excellent material from the Lower Permian of (mostly) Texas and Oklahoma. Most of this material, though housed at Field Museum, actually belongs to the University of Chicago. In fact, all of the university's paleontological collections are here, reflecting a recent centripetal trend of university museum collections of all kinds into a few large museums. The collection of Lower Permian tetrapods is excellent largely because paleontologists associated with the University of Chicago have been collecting and studying this material since the nineteenth century.

The Lower Permian is an interval in geologic time currently thought to range from about 255 to 270 million years ago. This is considerably earlier than even the most primitive dinosaurs, which appeared some 200 million years ago during the Upper Triassic. The largest dinosaurs are confined to the Jurassic and Cretaceous periods, which together span the time from 180 million to 70 million years ago. A number of typical Lower Permian vertebrates are displayed in Hall 38, including perhaps the most famous (and one of the largest)—*Dimetrodon*, a "sail-backed" pelycosaur. Pelycosaurs, which were primitive mammal-like reptiles, commonly occurred in the Lower Permian. Their contemporaries included a number of much more primitive reptiles, very similar to the earliest reptiles known, and a variety of large and small amphibians. One of the largest Lower Permian amphibians, *Eryops*, is also on display in Hall 38. Many of the amphibian groups disappeared by the end of the Lower Permian. Paradoxically, this period

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Left: Concentration of fossil bone from Agate Springs locality, of Lower Miocene age. Width: 78 inches.

is nevertheless a source of specimens which tell us much about primitive amphibians, the first land-dwelling vertebrates. Amphibians originated some 350 million years ago, approximately at the time of the transition from the Devonian period to the Mississippian, but relatively few specimens this old have been found. The Lower Permian amphibian fauna is naturally not the same as that of early Mississippian time. However, the similarities are strong enough to make the Lower Permian a valuable source of information about these much earlier amphibians.

Lower Permian tetrapod specimens tend to be rather unspectacular in appearance, and difficult to study. One reason for this difficulty is their relatively small size; but just as important is the usual type of preservation. Most specimens, even those a paleontologist would consider quite good, are more or less crushed and incomplete. Often they have been chemically altered in ways which make it hard to study them. Finally, but very important, is the fact that many are found in fairly hard rock. This must be removed by a preparator, generally using dental tools to chip and grind away the rock. In the process, no matter how skillful the preparator, specimens are inevitably damaged to some extent. In general, the smaller the specimen the more serious the damage will be. Some areas of small specimens, such as the braincase and palate, cannot be cleaned very thoroughly.

As a result, even my fellow paleontologists are liable to comment on some of my specimens in such terms as "Yuck! How can you make anything out of that?" To tell the truth, sometimes I can't. But often a combination of approaches will yield a surprising amount of information from even poorly preserved specimens. A particularly helpful approach is to use very well preserved material to interpret the morphology of a different but related species. Fortunately, Field Museum has some truly spectacular Lower Permian material. In this article I will describe a unique Lower Permian locality which has produced large numbers of excellent reptile and amphibian specimens. I will refer to it as the Kiowa locality since it is in southwestern Oklahoma, the home of many Kiowa Indians.

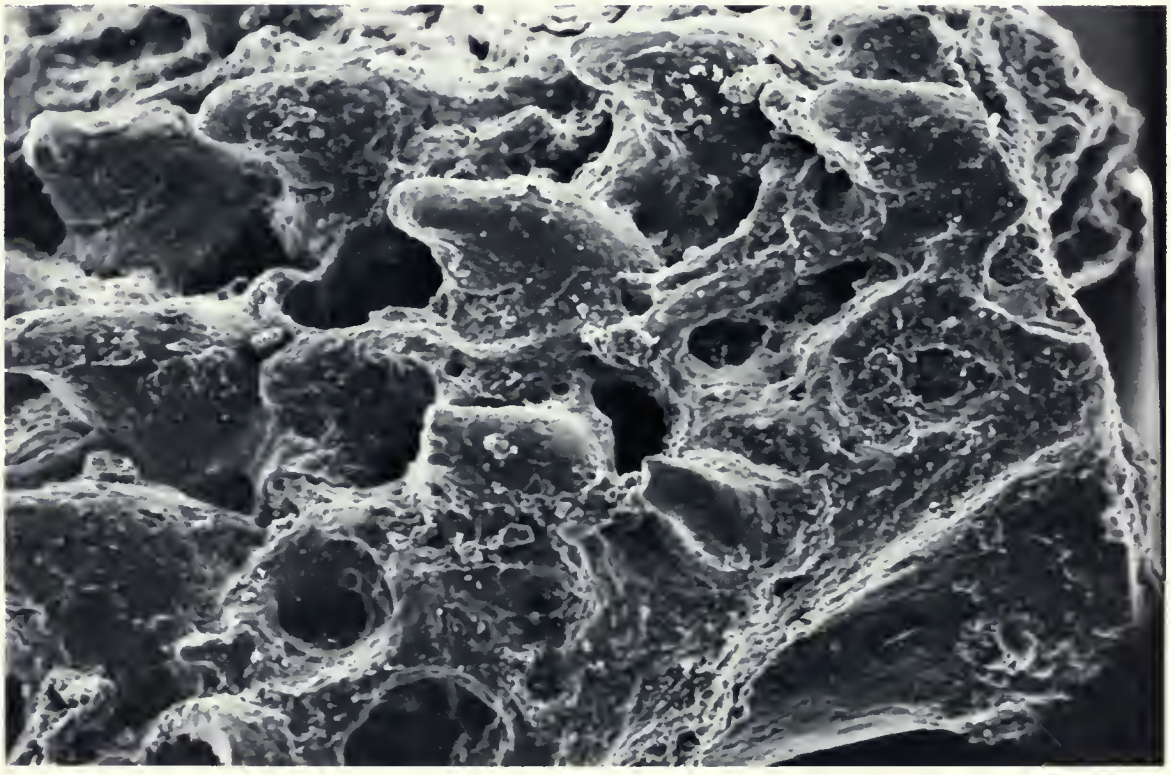
The Kiowa locality is a mass occurrence of fossil lower tetrapods; The photo on page 8 shows typical Kiowa material. Compare this to a concentration of fossil mammals from the Lower Miocene (about 20 million years ago), shown below. In each case the bones are shown in the positions in which they were found, although some of the covering sediment has been removed. Bones from both the Miocene and Lower Permian locality are comparably well preserved. They are of very different sizes, however. The Miocene fossils are about the size one would expect; the width of the area shown is 78 inches. The width of the Kiowa specimen, which also includes many bones (not easily visible here), is about 1.4 inches. The number of individuals represented at the Kiowa locality is undoubtedly in the tens of thousands, and may be much greater.

What accounts for such an unusual concentration? The Kiowa locality is a Lower Permian fissure fill in Ordovician limestones (roughly 470 million years old). Under the proper conditions, limestone deposits may develop an extensive system of interconnected fissures and caves, due to weak organic acids which dissolve the limestone. Where fissures open at the surface, they may form traps for animals. Probably most of the animals at the Kiowa locality were trapped in this way. It is possible, however, that some of them lived in the caves which were probably part of the fissure system. Except for one locality a few miles from the Kiowa site, I know of no other fissure locality this old which has produced any fossil tetrapods.

Left: Concentration of fossil bone from Kiowa Locality, of Lower Permian age. Width: 1.4 inches.

Aside from the abundance and small size of specimens, the Kiowa locality has other remarkable features. Most important is the fact that the fissure fills are mostly soft clay. Specimens can therefore be prepared with a minimum of damage, often simply by gently washing them with water in a screen-bottomed box. The amount of detail thus revealed is astonishing. The specimens shown on this page will give some idea of this. The photo reproduced below shows minute teeth from the roof of the mouth in a fossil amphibian. These teeth have a zone of weak calcification near their base, a discovery which I believe points to the origin of the living amphibians from a Lower Permian group. Such teeth are usually (and unavoidably) removed in preparation even of much larger specimens, from other localities. It is just not possible to clean between fragile teeth a millimeter or so apart, when they

Left: Scanning electron microscope photograph of a nearly complete bone (vomer) from roof of mouth of fossil amphibian (Doleserpeton annectens) *found at Kiowa locality. Width: about 2 mm.*



Right: Scanning electron microscope photograph of several denticles from roof of mouth, same amphibian species as shown above. Enlarged about 100 times.

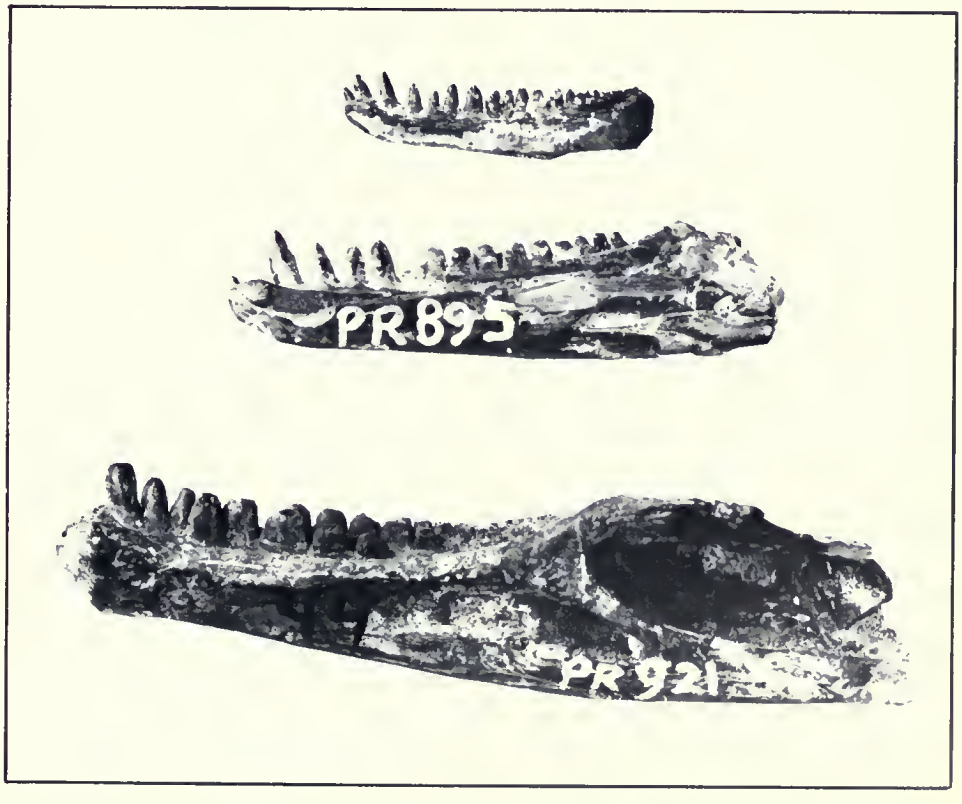
are imbedded in hard rock. Thin sections of Kiowa bone, when examined under a microscope, show growth lines within the tiny bones, the spaces (lacunae) once occupied by bone cells, and calcified cartilage at the ends of long bones. The shape and surface features of these ancient bones can be studied just as well as those of recently cleaned modern bones. And as a bonus, the Kiowa bones are quite strong and can be handled with little chance of damage.

The Kiowa fauna is diverse; I estimate that there are at least a dozen species of small reptiles and amphibians present. It is clear that for at least some species, a growth series is present. Shown below is a series of jaws from a small reptile, *Captorhinus aguti*, which is by far the most common species at the locality. *C. aguti* has an unusual dentition, recently studied by myself and Robert DeMar of the University of Illinois at Chicago Circle campus. We were interested in certain aspects of tooth replacement for which *C. aguti* might provide a model—but only if such perfectly preserved material was available. *C. aguti* exemplifies another important aspect of the Kiowa fauna: its terrestrial nature, which in the case of *C. aguti* can be confirmed from other localities where the species occurs. Most known Lower Permian tetrapods were inhabitants of rather low-lying areas in a widespread system of deltaic sediments (that is, sediments deposited as river deltas near the point where ancient rivers entered a sea). The majority of Lower Permian tetrapod faunas therefore include stream- and pond-dwellers, and terrestrial animals which lived in close proximity to water. The faunas of better-drained areas are not so well known. The Kiowa fauna, however, consists almost entirely of terrestrial animals; aquatic species are extremely rare.

The Kiowa locality has been known to paleontologists since 1938. There are considerable collections of this material in a number of museums, although I believe the collection in Field Museum is now the most extensive. In view of the description above, one might think that this material has been thoroughly studied. In fact, surprisingly few papers have dealt with Kiowa specimens. One reason for this may be the small size of the animals. This is suggested by a story I heard about a well-known paleontologist who, among other interests, had studied the Lower Permian for years; the Kiowa locality was discovered toward the close of his long and distinguished career. He obtained some of the material, but never worked on it because it was "just little stuff."

Small size, however, is not the major reason for the relative lack of interest in Kiowa material. The problem is the disarticulated condition of almost all of it: There are innumerable individual bones, but few skulls, either complete or partial; and entire skeletons—skull, vertebral column (backbone), and limbs—are almost nonexistent. I know of more than one person who began work on the fauna but eventually gave it up because of the difficulty in determining just which pieces belonged together. The mixture of numerous species, some of them undoubtedly new, and at various growth stages, was just too hard to untangle.

I would like to report that by sheer brilliance I have succeeded in overcoming these problems. This, alas, is not the case. I have, however, been able to learn quite a lot about the fauna by more prosaic methods. Although specimens (other than *C. aguti*) with even a few bones in their natural association are very rare, they do occur. Each such fragment makes it possible to assign many individual bones to a single species. And sometimes a nearly complete specimen is found. I was fortunate to find several such specimens at the beginning of my study several years ago, and others have shown up since. As a result, although I also collect and study other areas, I am still excited about this unique locality. The association of most of the disarticulated bones is still uncertain, but I think that many more bones can eventually be assigned to the proper species. There is no better source of information on the small terrestrial tetrapods of the Lower Permian, and the importance of the locality is bound to increase as more associations are made. Thus, despite the small size of Kiowa animals—or perhaps because of it—the search is just as exciting as a dinosaur hunt. □



Three lower jaws of the small reptile Capthorinus aguti, *from Kiowa locality. Enlarged about 3 times.*

THE SMALL CHILD AND THE BIG MUSEUM

Preparing for the First Visit

By Barbara Reque

To describe Field Museum with superlatives such as "huge," "enormous," or 'vast," is still indulging in understatement, especially if it is viewed through the eyes of a small child. A visit to the Museum can be a frightening and confusing experience for the preschooler or even older child who is unprepared. But with some guidance, that child's visit can be rich, exciting, and immensely rewarding.

The Museum is unique in a great many ways, and it offers the young child a marvelous opportunity to discover the world. For example, it is the only place in Chicago where children can see all four seasons at the same time, meet creatures and cultures that don't live any more, and find out what Chicago was like 200 years ago.

How the child is oriented before coming will have a great deal to do with how he or she responds to the visit. It should be made clear that the animals on exhibit are no longer alive, that they are mounted and arranged just to show what animals look like. The child should be told that the Museum doesn't go about killing animals, that animals that die at zoos are sent to the Museum.

The kinds of exhibits that will be seen should be discussed, with emphasis on one subject of general interest to all of the children involved in the trip. The teacher or group leader should study reference materials about this subject before visiting the Museum. The more preparation that is made, the more rewarding the trip will be.

Before I joined the Field Museum staff, I was involved with an early childhood program in a Chicago public school. We hoped to augment the children's appreciation for their own culture, and to help them to understand that different societies solve the same problems in different ways, depending upon what materials are available to them. One of our activities at the school was to study the ways of the Stone Age people. We brought in bones, leather strips, rocks, tree branches, and asked the children how they would use these natural materials to make the tools they would need if they had to live as Stone Age people. The children reinvented the wheel, the rock hammer, the slingshot, the spear, and the chisel. Expectedly, their creations did not always work out as well as their designs. At first the rocks on their rock hammers came loose when they tried to use them, their wheels fell off their carts, and their stick house (which looked remarkably like Eeyore's house in *Winnie-the-Pooh*) fell apart everytime anyone tried to move in. After a certain amount of trial and error, however, the rocks stayed put, the children gave up on wheels (they decided to use sledge-like vehicles), and they abandoned the stick-house idea—moving under a table (which they called a cave).

Barbara Reque is a senior program developer in the Department of Education.

As a result, when they visited the Stone Age Man exhibits at Field Museum they expressed a great deal of respect for these resourceful people who had the skills to make tools that remained intact. The children also expressed a great deal of satisfaction that they, too, had developed the skills to do this. Although this was a school project, it could also be an activity for the individual or for the entire family. Such a project can focus on any culture. We continued the school program with units on American Indians, Africans, and contemporary Americans.

At the Museum

When you come to the museum, you may discover that you are taking a trip quite different from the one you planned. Stanley Field Hall, with its great elephants and dinosaurs and fascinating fountains, may be as far as you get for awhile. Leave time to stop, look at, and absorb these and other things that catch the children's interest as you pass on the way to your special subject. When you come with a group of children, each child will frequently want to see something different. One way to handle this problem is to look at each of these things in turn. Your own interest as well as the pre-visit activities should help the children to maintain an interest in the principal subject of your visit. With one child you can stop to look at anything that may interest him; his interest (and your participation to extend that interest) will set the pace for your visit. One exhibit or even a segment of an exhibit may completely fascinate a child.

On one occasion a four-year-old girl, Darbi, and I began our tour at one of the fountains in Stanley Field Hall. Darbi and I looked at one fountain for half an hour. We ran out of conversation about the fountain after about ten minutes, but Darbi did not run out of interest. After another ten minutes I asked if she was ready to move on, and she replied that she wanted to stay to watch the fountain some more. After another ten minutes I remarked that we really should go to see other things, but she said no, she wanted to wait there. I asked why she wanted to wait, and she asked "When is it going to fill up?" After I explained that the fountain would not fill up but would just keep on splashing so it would look pretty, she said that was very nice and could we look at the other one.

Ways to Get Involved in Museum Exhibits

Even though the Museum exhibits are behind glass, children can get very involved in them. By means of questions and suggestions you can encourage children to touch the exhibits with their imaginations. When children ask questions about the exhibits, respond by asking them to help *you* find the answers. Look together at different features of the presentation. There is much in the exhibits for you as well as for the children to learn from. In one of the Indian dioramas which Darbi and I studied (we finally got past the fountains), she was able to identify the roles of the various persons represented and what kind of tasks they were involved in.

She wanted to know how they entered the teepee; before I could answer, she had already located the teepee entrance. She also discovered something that had always escaped me: the inside of the teepee is furnished. On another visit with a group of children to the Indian exhibits, I learned again how much there is to observe and discover in the dioramas. The youngsters informed me that the children in one diorama were making a model house just like the big house that the father was constructing. It was a detail that I had never noticed. The children also commented that this was a way of learning, just as they learned how to do things from their parents at home.

During her visit, as we walked past some statues, Darbi showed me another way to become involved. She put her own body in a posture imitating the statue's. I think she even got to feel like that statue, since a very similar smile came to her face. In the Contemporary African Arts Exhibit she picked out her favorite statue, one of an ant-bear, and all at once we had Darbi the ant-bear. She stopped to draw a picture of the ant-bear. Drawing in the museum is an activity open to young children as well as to older students and professional artists. It is an activity that we think should be encouraged at all museums.

Bring paper and crayons along when you come so that the children will be able to have the pleasant experience of drawing pictures in the museum. When they get down on the floor to draw, the vast museum suddenly becomes a very intimate place. If the children want to draw what they see they will benefit in at least three ways: They will learn to observe what they see more carefully; they will get a chance to stay in one spot and relax and discuss what they see; and they will have a picture to keep following the visit to remind them of their discovery. Be sure to write the name of the subject on the picture so you can identify it later. The children will probably remember, but you might forget. Some of the pictures may look very much like elaborate smudges, and the colors may be inaccurate, but the children will have recorded their impressions. The giraffe may look like a bird, the elephant may be a large black rectangle with no feet, and the lion may be a pink explosion. The accuracy isn't as important as the perceptions expressed. In the large rectangle the child expresses the elephant's great size; the pink explosion represents the lion's impressive mane.

Some children will not want to draw, or they will want to draw only briefly. That's not a hindrance to the other children. As some children continue to draw, the nondrawers can talk to them about their pictures, go up to the cases to look more closely, and think of questions and answers about the exhibits. One question can lead to a lot of discoveries. One group I worked with spent an hour finding out what kinds of feet different animals have.

Today's very young museum visitor is the potential museum "regular" of the future. I hope that through positive experiences at Field Museum, children will learn to look to museums for learning with pleasure.

For information or materials to help teachers, parents, and group leaders to plan museum experiences for children write to Harris Extension, Department of Education, at Field Museum.

our environment

Kirtland's Warbler Increase

According to the latest census, the world's population of Kirtland's warblers now totals 358, an increase of 24 over last year. The census was made by the Michigan Department of Natural Resources, the U.S. Fish and Wildlife Service, and the Michigan Audubon Society. The population of the warbler is determined by walking through prime nesting areas and counting the songs of the male bird. Because the bird is essentially monogamous and territorial in nature, each singing male counted is considered to represent one pair of warblers.

The Kirtland's warbler is an endangered species which nests only in the jack pine country in northeastern Michigan. Each year, after nesting and raising its young, the bird returns to its winter range in the Bahama Islands. Since 1903, the Kirtland's warbler has been recorded nesting in about a dozen counties of north central Lower Michigan.

Modern forest fire control has prevented the creation of new habitat suitable for the Kirtland's warbler and several areas have been designated as management areas. In these sites, controlled burnings, timber harvesting and special plantings are made to produce the young pine needed by the bird. Also, parasitism by the brown-headed cowbird, a major problem, is being halted by trapping. The cowbird lays its eggs in the warbler nest and the warbler, unwittingly hatches them. The young cowbirds emerge earlier than the warbler's own young and eventually take over the nest.

Wildlife Conservation: Another View

The following statement by Paul M. Kelsey, New York State Regional Conservation Educator, appeared recently in Conservation Comments, *a publication of the New York Department of Environmental Conservation. It is reproduced here, not as an endorsement of Kelsey's views, but to acquaint* Bulletin *readers with yet another, well informed approach to wildlife conservation.*

"There are many people with the well-being of wildlife at heart who honestly think that hunting should be abolished. If their wish should become true, what effect would it have on wildlife populations—both game and non-game?

"If big game hunting were to be abolished, the deer herd would increase very rapidly, more than doubling its size in two years in the better parts of its range. If you do not know the implications of this statement, it sounds just fine. At some point—and starting with the fairly large deer herd that we already have [in New York state], it would not be very long—the deer would so overbrowse their range that all the reasonably good deer foods would be severely damaged or destroyed. With nothing left to eat but poorer quality food, they would suffer malnutrition and starvation. Ultimately the population would stablize at a much lower level than we have now.

"Agricultural crops, which even now are often seriously damaged, would be very severely hit in the absence of good natural foods. Increased numbers would also mean many more car-deer accidents with their financial and lethal potential.

"If small game hunting were stopped, there would be little noticeable effect immediately, for 60 to 80 percent of all small game is lost every year due to normal causes. With few exceptions, hunting is part of this normal mortality, not in addition. Hunters provide over $90 million each year throughout the nation from their hunting licenses for wildlife management programs. Much of this goes to acquire and maintain upland game habitat. This year about $6.5 million will be paid in license fees to hunt big and small game in New York state alone. The end result would be a reduction in wildlife numbers because of the loss of habitat.

"The effect of abolishing hunting might be more dramatic in the case of waterfowl than for small game because their habitat is more vulnerable to habitat destruction and deterioration. In addition to the license money mentioned above which also is used for wetland areas, the sale of duck stamps, required to hunt waterfowl, brings in over $3 million each year specifically for waterfowl management activities.

"Not all the money for waterfowl from the sportsmen's pockets is channeled through the government. Each year they donate over $2 million to private groups such as Ducks Unlimited to help restore and maintain wetland areas, particularly the critical ones in the Canadian prairie provinces where a large percent of the country's waterfowl are reared.

"The key to maintenance of waterfowl populations is continual maintenance of good breeding grounds, resting grounds along the migration routes and wintering grounds. Without adequate habitat in all three situations, waterfowl would quickly dwindle in numbers. These are purchased and managed with hunter's dollars.

"Game lands and wetlands supported by hunter's dollars not only support the game upon which their sport is based, but as a by-product also support a myriad of other wildlife. Wetlands saved for waterfowl are also vital to many aquatic forms of life which depend on them as nursery areas.

"Much of the research work being carried out on wildlife is supported by the excise tax on sporting arms and ammunition. Funds for this too would dry up as soon as hunting is eliminated.

"All across the country most of the conservation laws are enforced by personnel paid mainly from fish and game license money. Without hunting, some of the law enforcement problems would be eliminated, but not the hard to control problems, such as poaching.

"The prohibition of hunting would change the obvious hunting mortality among wildlife to a less obvious mortality of disease, predation and starvation. There might be some initial increases in wildlife populations if hunting was banned, but because of the decrease in the quality of habitat through the loss of license dollars, there would be an ultimate decrease in the amount of all types of wildlife."

Wood: The Ultimate Fuel!

Wood was very likely the first fuel used by early man. Only in the past 200 years or so has it been substantially displaced by coal, oil, and gas. But now with the energy crisis, rising costs of fossil fuels, and greater concern for the atmospheric pollutants they produce, there is plenty of reason to use more wood for fuel—at least for domestic heating—besides, wood-burning is more fun! The wood-burning fireplace is very "in" today.

The substantive advantages of wood are really considerable. It is much lower in irritating pollutants than most fuels—it has a low ash content and usually burns cleanly, giving off water and carbon dioxide and leaving only a minimum of ash as waste. The ash can be applied to the soil as garden fertilizer. Wood is also relatively inexpensive.

Coal, gas, and oil are limited resources that can't be replaced once they are used. They require expensive equipment, manpower, and energy to locate, extract, and process. Wood, on the other hand, is a renewable resource, and good forestry practices can improve wildlife habitat.

Trees that are diseased, poorly formed, or which are little-used or considered weed species occupy valuable growing space, and the planned cutting of healthy trees is an integral part of forest management. Firewood may often be found at landfills and in municipal dumps in the form of tree trunks and branches that have been cut down and partially sawn up.

Industrial scrap may be another source of firewood. Sawmills accumulate slabs, trim, and edging in their millyards. Power companies may also offer the logs, limbs, and treetops that result from their powerline maintenance.

The amount of heat produced by a

(*Continued on p. 18.*)

FIELDIANA

An Excerpt about Coffee

Fieldiana is a continuing series of scientific papers and monographs dealing with anthropology, botany, geology, and zoology intended primarily for exchange-distribution to museums, libraries, and universities, but also available for public purchase.

Field Museum's *Annual Report of the Director* for 1895 introduced the series which would one day be called *Fieldiana* as "the medium of presenting to the world the results of the research and investigation conducted under the auspices of the Museum. . . ." Since then, more than 1,200 issues of *Fieldiana* have been published.

The series has reflected not only the growth and development of Field Museum, but of the various sciences as well. For example, anthropology was just emerging as a professional discipline in the United States at the time of *Fieldiana's* introduction and some of the most important early anthropologists contributed to the series.

Any title of *Fieldiana*—dated 1895 or 1975—can be examined in the Museum library. All that are not out of print are available for purchase.

In this age of imperative relevance, *Fieldiana* is relevant. It describes and interprets our world and its inhabitants as it was and is. For conservationists of both human and natural resources, *Fieldiana* provides a record of what was so that we can measure what we have changed, improved, or destroyed. *Fieldiana* has been pure science as well—irritating to those who demand "But what can you use it for?" but inspiring to those who appreciate and desire knowledge for its own sake.

Among the most ambitious and comprehensive of the *Fieldiana* monographs is "Flora of Guatemala," a series on the flowering plants of that country which had its inception almost 30 years ago. Several volumes in the series have appeared thus far, with a total of nearly 6,000 pages and about 1,500 botanical illustrations.

"Flora of Guatemala" is unquestionably one of the most comprehensive studies of the plants of a particular geographic region in the history of publishing. The text reproduced here is from the most recent volume to be issued (Vol. 24, Part XI, Nos. 1 to 3, by Paul C. Standley and Louis O. Williams; 283 pp., 68 illus.) The excerpt will be of special interest to coffee-lovers who have been disturbed by news of recent freezes affecting coffee-producing areas of Brazil, the source of much of the coffee consumed in the United States.

This volume, as well as the rest of the *Fieldiana* series still in print, is obtainable by writing Field Museum's Office of Publications. Catalogs are also available for each of the principal disciplines: anthropology, botany, geology, and zoology.

COFFEA Linneaeus. Coffee

Shrubs or small trees, usually glabrous, the branchlets subterete; stipules rather broad, persistent, acuminate; leaves opposite, membranaceous or subcoriaceous, sessile or petiolate; flowers axillary, glomerate, sessile or short-pedicellate, white, fragrant, the pedicels bracteolate, the bractlets often forming a cupule; hypanthium subcylindric to turbinate, the calyx short, truncate, dentate, or lobulate, persistent, often glandular within; corolla salverform or funnelform, the tube short or elongate, glabrous or villous in the throat, the limb 5-8-lobate, the lobes oblong, obtuse, spreading, contorted in bud; stamens usually 5, inserted in the throat of the corolla, the filaments short or none; anthers dorsifixed near the base, linear, obtuse or acute, included or exserted; ovary 2-celled, the style filiform or thickened, glabrous, the 2 branches linear or subulate; ovules solitary in the cells, affixed to the middle of the septum; fruit baccate, globose or oval, dry or fleshy, containing 2 nutlets, these coriaceous or chartaceous, convex dorsally, sulcate ventrally.

About 40 species, in tropical Asia and Africa, some of them now grown in all tropical regions of the earth.

Flowers 5-parted.....C. *arabica*.
Flowers 6-8-parted.....C. *liberica*.

Coffea arabica L. Sp. Pl. 172. 1753. *Cafe; coffee*. Figure 45.

Native of tropical Africa, now grown in most tropical regions of the earth for its seeds; planted in all Guatemalan departments except probably Totonicapan, rarely spontaneous in virgin forests.

A glabrous shrub or small tree as much as 5.5 m. tall with thin gray bark; wood white, moderately hard and fine-grained; leaves short-petiolate, oval or elliptic, 7-20 cm. long, 3-7.5 cm. broad, acuminate, cuneate at the base, subcoriaceous, usually persisting for three years, with 7-12 pairs of lateral nerves; flowers in clusters of 2-9 or more, sessile or nearly so, 12-18 mm. long; bractlets ovate, the inner ones connate at the base of the pedicel, shorter than the 5-denticulate calyx; corolla lobes equaling or exceeding the tube; anthers exserted; fruit about 1 cm. long, at first green, then red, finally blue-black.

Commercially coffee is the most

Coffea arabica. A, branch with immature fruits and flowers, X ⅓; B, partially dissected segment of inflorescence, x 5; C, cross-sections of fruits, x 1; D, seedling, x ½.

important plant of Guatemala and local prosperity is dependent primarily upon the coffee crop and its market. When coffee production is good and the price is high, Guatemala, like other Central American countries, is prosperous. When its price in the world market is low, hard times prevail. Foreign credit for the purchase of essential imports is heavily dependent upon the money received from export of the coffee crop. Coffee was introduced into Guatemala around the middle of the 18th century, but its cultivation did not have more than local importance until about 1875. Coffee and bananas now make up the major portion of Guatemalan exports.

Guatemala has long been celebrated for the quality of its coffee and it is the leading Central American producer of this product. According to statistics of the Asociacion Nacional del Cafe of Guatemala, the crop in 1970-1971 amounted to 2,800,000 hundredweight or *quintales de oro*. All of the departments produce coffee except Totonicapan where the land is too high for the production of coffee, as are the highlands of some of the other departments. The leading departments in coffee production are listed as: Escuintla, 6,256 metric tons; Santa Rosa, 12,604 metric tons; Quezaltenango, 16,468 metric tons; Suchitepequez, 14,996 metric tons; San Marcos, 25,668 metric tons; Alta Verapaz, 6,302 metric tons. It is thus apparent that the *bocacosta* region of five western departments produced much more than half of the crop, while the Coban region, which is sometimes assumed to produce most of the coffee of Guatemala actually produces only a small percentage of it. The yield in some of the departments is, of course, very small. The lowest producers are Peten, Izabal, and El Progreso, all of whose land is too low for commercial cultivation. Most Guatemalan coffee is grown on the lower or middle slopes of the mountains, at 600 to 1,500 m., but some is planted as high as 1,800 m., near Chimaltenango. The coffee of Antiqua (1,500 m.) is noted for its excellence. Guatemalan coffee is considered a delicacy in many nations around the world; the resulting high price for the coffee has encouraged an increasing cultivation of the crop to the extent that it comprised (1972) approximately 46 per cent of Guatemalan exports with a value of $92,000,000.

Almost all the coffee of Guatemala is grown shaded, at lower elevations for protection from the sun, at high elevations for protection from the cold. Several species of *Inga* usually are used to provide shade. Often tall forest trees are left when the land is cleared, and various kinds of fruit trees are planted in the *cafetales*. The valley of Antigua as well as the coffee-growing regions of the Chimaltenango uplands are unique in that the coffee shade consists of *Grevillea* trees, which are said to be the best protection against cold winds and fogs. At these high elevations the harvest begins January 1 or even later, when all the lowland coffee has long been gathered. In the Pacific *bocacosta*, especially at lower elevations, as well as in Alta Verapaz, bananas and plantains are much used for shade, with the production of two saleable crops on the same land. Some of the most unusual plantations are found in the higher parts of Quezaltenango, between San Martin Chile Verde and Colomba, where, at about 1,500 m., the *cafetales* are without shade and the soil consists of the loose whie sand characteristic of this region.

On the Pacific slope, as well as in Alta Verapaz, much coffee is planted on the exceedingly steep slopes of *quebradas* and *barrancos*, to which it is difficult even to climb on foot. The lower and more level land of these *barrancos* usually is devoted to maize, sugar cane, and other crops. At lower elevations the coffee harvest begins soon after the rainy season, but at high elevations the coffee ripens much later. Therefore, taking the country as a whole, the some 129,000 metric tons of pure coffee that was produced in 1970-1971 was harvested throughout much of the dry season.

Traveling from one part of Guatemala to another, it is possible in almost any season to find ripe berries on the bushes. Flowers are another matter, and are seldom seen, unless one is in the proper locality on just the right day. A *cafetal* in flower is one of the most beautiful sights imaginable, accentuated by the delightful fragrance pervading the air. All the bushes burst into bloom on the same day, and in two or three days the flowers have disappeared. The date of flowering is not constant for any locality, it depends largely on rainfall. In Alta Verapaz, where there is constant moisture, the blooming extends over several months, and the harvest likewise is prolonged, while in other regions the berries are gathered at one time.

In all the markets of Guatemala coffee is offered for sale for home consumption, and at Antigua, for instance, excellent coffee is sold quite inexpensively. Apparently, no coffee that passes through a *beneficio* is wasted, for the beans thrown out when coffee is cleaned for export are all offered for sale in the markets for a very low price. Cheap as it is, there are many Guatemalans who cannot afford the beverage, but use in its place *atol* or other drinks prepared from maize and other substances. Also, various seeds, especially those of Cassias, are used for adulterating or substituting for coffee. In times past coffee was often served in Guatemala in the form of *esencia*—essence—which was obtained by boiling the pulverized beans. The concentrated essence was then diluted by adding hot water or milk to suit the taste of the user. Today essence of coffee is rarely seen and coffee made in pots is the order of the day. Instant coffees are becoming more popular and are often served in hotels and restaurants. Where American tourists abound coffee is made to American taste and often is no better than that served in American hotels or cafes—or in homes, for that matter. Some of the best coffee anywhere is served by the National Coffee Association at the airport in Guatemala City.

Official "propaganda" for all countries from Mexico to Peru indicates that the best coffee in the world comes from the country being propagandized—and this may be true. The junior author, having been Consul of Guatemala in Chicago for many years, is quite sure that no coffee quite compares in flavor or aroma to that of Guatemala!

The names coffee and cafe are both derivities of the Arabic word, kahweh, signifying wine. Coffee is a vegetable product of relatively recent introduction into the civilized world. It is believed that it reached Arabia from Africa during the fourteenth century, and did not attain common use in Europe until around the middle of the seventeenth century. It did not become a common crop in Central America until after the middle of the nineteenth century.

Coffea liberica Bull, Retail List New, Beautif. and Rare Pl. No. 97: 4.1874. *Cafe robusta; Liberian coffee.*

Native of Liberia and adjacent regions of West Africa; cultivated on a small scale in Guatemala.

A glabrous shrub or tree, sometimes 10 m. high but usually much lower, at least in cultivation; leaves short-petiolate, coriaceous, lustrous, mostly elliptic-obovate, 12-30 cm. long, 5-12 cm. broad, short-acuminate, acute or obtuse at the base, the lateral nerves 8-12 paris, domatiate in their axils; flowers several in a cluster, subsessile, 2.5 cm. long; bractlets connate, shorter than the subtruncate calyx; corolla lobes about as long as the tube; anthers exserted; fruit 2-2.5 cm. long or even larger, yellowish red, turning black.

This species is said to be planted in various regions of Guatemala, but is little esteemed. We have noted but one plantation of any size, in Retalhuleu near Chivolandia, but there are said to be others in the Pacific *bocacosta* and in Alta Verapaz. In its habit of growth *Coffea liberica* differs noticeably from *C. arabica*. The leaves are twice as large and rather handsome. Flowering is continued through much of the year and the berries hang upon the bushes for a long time (in *C. arabica* they soon fall if not picked). Liberian coffee is said to produce better at lower elevations that *C. arabica*, and to be less susceptible to fungus diseases. However, it never has become popular in American countries.

It is worthy of note that in Guatemala *Coffea liberica* is known among even the laborers as *Cafe robusta*, but it is not *Coffea robusta* Linden of tropical Africa, which often is known as "robusta coffee."

Coffea excelsa A. Chev. Rev. Cult. Col. 12: 258.1903.

Shrubs said to be of this species were seen growing in the grounds of the Direccion de Agricultura in Guatemala years ago. It is an African species that produces low-grade coffee, and is cultivated in some regions of Africa.

Coffea corymbulosa Bertol. Fl. Guat. 410. 1840.

This was based upon material collected by Velasquez at some unspecified locality in Guatemala. Bertoloni states that "*Coffea arabica* differs from this in its acuminate leaves and subsessile flowers." It is suspected that the plant so named may be merely *Coffea arabica*, but it may be a representative of some different genus. This cannot be determined without examination of the type specimen, in the Bertoloni herbarium in Italy. . . .

field briefs

Environmental Films

In conjunction with the *Man in His Environment* exhibit, opening November 9, a series of films will be offered by the Department of Education; each deals with a specific environmental problem or topic not dealt with in the exhibit. The selection of films represents a distillation of more than 350 considered for the series. Screenings will be in the Meeting Room, second floor north, on Fridays, Saturdays, and Sundays at 11:00 a.m. and again at 1:00 p.m.

NOVEMBER — Ecosystems: Films dealing with a variety of natural communities. Nov. 9, 14, 15, 16. *"Mzima: Portrait of a Spring."* Nov. 21, 22, 23: *"High Arctic Biome," "Billion Dollar Marsh."* Nov. 28, 29, 30: *"Survival on the Prairie."*

DECEMBER — Adaptations for Survival: Special adaptions of flora and fauna, their relationships to each other and to the environment. Nov. 5, 6, 7: *"Baobab: Portrait of a Tree."* Nov. 12, 13, 14: *"Hunters in the Reef."* Nov. 19, 20, 21: *"Strange Creatures of the Night."* Nov. 26, 27, 28: *"Bird's Paradise: The Waddensea."*

JANUARY — The Vanishing Wilderness: Films by Shelley Grossman, film producer for Field Museum's Man in His Environment exhibit, that deal with a variety of ecosystems and the political, economic, and social changes that must occur if wilderness areas are to be saved. Jan. 2, 3, 4: *"Of Broccoli and Pelicans and Celery and Seals."* Nov. 9, 10, 11: *"Chain of Life."* Jan. 16, 17, 18: *"No Room for Wilderness."* Jan. 23, 24, 25: *"Santa Barbara—Everyone's Mistake."* Jan. 30, 31, Feb. 1: *"Will the Gator Glades Survive?"*

FEBRUARY — Human Alternatives: Key environmental problems that we now must face. Feb. 6, 7, 8: *"Pollution—A Matter of Choice."* Feb. 13, 14, 15: *"Multiply and Subdue the Earth."* Feb. 20, 21, 22: *"The Great Sea Farm," "Should Oceans Meet?"* Feb. 27, 28, 29: *"But Is This Progress?*

MARCH — The Question of Tomorrow: Documentary and fantasy versions of what the future can hold for us. March 5, 6, 7: *"Future Shock,"* Feb. 12, 13, 14: *"The Unexplained."* March 19, 20, 21: *"Technology: Catastrophe or Commitment," "Urbanissimo."* March 26, 27, 28: "Energy to Burn," *"Man in the Second Industrial Revolution."*

How Astronomy Influenced Botany

A unique exhibit (below) on view in the South Lounge, shows how the world of plant study, especially in England, was influenced by the successes of astronomy in the seventeenth century.

The exhibit features displays on classic studies of respiration in plants by Stephen Hales (1677-1761) and Robert Hooke's (1635-1703) study of microscopic structure in plants and animals. The exhibit was provided and mounted by IBM.

J. Eric Thompson, 1898-1975

Sir J. Eric Thompson, a research associate in Central American archaeology in the Department of Anthropology and one of the foremost authorities on the Maya civilization, died September 9 in Cambridge, England. He was 76. Sir Eric, recently made a Knight Commander of the British Empire, was appointed to the Field Museum anthropology staff in 1926. At the time of his resignation, in 1935, he was assistant curator of middle and South American archaeology.

He was the author of many research monographs and books published by Field Museum, the Carnegie Institution of Washington, and the University of Oklahoma Press. His most widely read works are *Maya Hieroglyphic Writing, an Introduction; The Rise and Fall of Maya Civilization; Maya History and Religion;* and *The Civilization of the Mayas*. The latter work was first published by Field Museum in 1927, a seventh revised edition in 1973.

Sir Eric was last at Field Museum in 1967, when the Women's Board honored him with a luncheon in celebration of the fortieth anniversary of the first printing of *The Civilization of the Mayas*.

OUR ENVIRONMENT (*from p. 14.*)

fireplace log depends on the relative percentages of woody material, resin, water, and ash. A standard cord of dry hardwood weighs about two tons and gives as much heat as a ton of coal, 200 gallons of fuel oil, or 24,000 cubic feet of natural gas.

Cedar, pine, spruce or hemlock ignite quickly and therefore make good kindling. Softwoods like pine, spruce, hemlock, or fir burn rapidly and produce quick, warming fires with hot flames that die quickly. Hardwoods like ash, maples, birch, and oak burn less vigorously and produce steady, glowing coals and a long-lasting fire. Woods of fruit or nut trees such as apple, hickory, cherry, and beech give a pleasant fragrance when burned.

Jim Swartchild

Mrs. Hermon Dunlap Smith, Mrs. Harold Grumhaus, and Mrs. Stanton R. Cook (l. to r.) prepare invitations to "Man in His Environment" preview.

"Man in His Environment" Preview

Field Museum's major new permanent hall, "Man in His Environment," will open Friday evening, November 7, with a smashing preview, reception, and dinner. Sponsored by the Women's Board and headed by Mrs. J. Harris Ward, this gala event has been designated the Museum's Bicentennial Celebration with the theme "In Praise of Our Planet."

Together with Mrs. Ward, Mesdames Henry D. Paschen, Jr. (Maria Tallchief), Mrs. Noel Seeburg, Jr., and Mrs. Wesley M. Dixon have arranged a program of music and entertainment featuring the arts of song, dance, and painting. Also assisting were Mesdames Vernon Armour, Edwin R. Blomquist, James R. Coulter, Gordon Lang, John Runnells, and Thomas S. Tyler. At their homes, Mrs. Philip K. Wrigley and Mrs. John Nuveen hosted all-day sessions addressing invitations for the preview.

PREVIEW
Man in His Environment

Name _____

Street _____

City _____

State _____ Zip _____

Phone _____

No. of tickets at $32.50 each: _____

Check enclosed for $ _____

I am unable to attend but wish to contribute $ _____ .

Please make check payable to Field Museum.

Seating to be arranged.

Ribbonwork Workshop

A group of students at Field Museum (lower left) concentrate intently as one of them tries her hand at ribbonwork, a craft long practiced by woodland tribes of eastern North America. An example of this craft is shown at lower right. The girls—all students at Chicago's Goudy Elementary School—were participating in summer activities of the O-wai-ya-wa program, an extension of that school.

Ribbonwork instructor was Sarah Keahna, of the Mesquakie (Sac and Fox) Tribe. Examples of this craft, on exhibit in Hall 5 (Indians of eastern North America) were followed as the girls sought to duplicate the delicate artwork. John White, coordinator of Native American programs at Field Museum, was resource person for the workshops. The Max Goldenberg Foundation, administered by Harris Trust and Savings Bank, provided funding.

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OCTOBER at Field Museum

NEW PROGRAMS AND EXHIBITS

MAN IN HIS ENVIRONMENT: *"MAN'S ONE WORLD"*

A FILM-LECTURE SERIES focuses on the impact of ecological disturbance upon traditional cultures. Anthropologists will discuss the films and answer questions about these pressures and changes. Ground floor lecture hall, Fridays 7:30 p.m., repeated on Saturdays, 2:30 p.m.

Oct. 3, 4:	***"The Tribe that Hides from Man"***
Oct. 10, 11:	***"The Turtle People"***
Oct. 17, 18:	***"The Last Tribes of Mindanao"***
Oct. 24, 25:	***"The Ice People"***
Oct. 31, Nov. 1:	***"Man of the Serengeti"***
Nov. 8, 9:	***"The Village"*** (Saturday, Nov. 8, members only)
Nov. 14, 15:	***"Ishi in Two Worlds"***
Nov. 21, 22:	***"Sky Chief"***

ADULT EDUCATION

NONCREDIT COURSES for persons over 18 in the natural sciences and anthropology. The fall courses (the first of a series of three) will be offered on six consecutive Thursday evenings, 7-9 p.m., beginning October 16, and run simultaneously. Course subjects are "Flowers and Pollination," "Oceanography," "Cultures of Native North America," "Reptiles and Amphibians," and "Rocks, Fossils, and Man." Registration is limited to 25 persons per course. Member's fee: $25; nonmember's $30. For further information see September ***Bulletin*** (p. 13) or write or call Adult Education Programs (922-9410, ext. 351).

CONTINUING PROGRAMS AND EXHIBITS

SPECIAL BOTANICAL ILLUSTRATIONS EXHIBIT

TWO HUNDRED YEARS OF BOTANICAL ILLUSTRATIONS FROM KEW GARDENS, ENGLAND, includes 123 plant illustrations ranging from mushrooms to orchids. Pen-and-ink and watercolor are the dominant media. Hand-colored lithographs and several etchings of Kew Gardens are also included. Three-dimensional plant models from the Field Museum's outstanding collection add their own form of illustration. Eighteenth century music is played continuously to further enhance the beauty of the exhibit. Hall 9, through Nov. 16.

SATURDAY DISCOVERY PROGRAMS

TOURS, DEMONSTRATIONS, AND PARTICIPATORY ACTIVITIES are offered continuously, every Saturday, 11:00 a.m. to 3:00 p.m. Topics vary, but often include: DINOSAURS: Clay modeling in the Hall of Dinosaurs. Make a dinosaur to take home. EARLY MAN: A tour that traces major trends in man's physical and cultural evolution. FOODS OF THE SOUTHWEST NATIVE AMERICANS: Try free samples of foods from Hopi, Navajo, and Zuni peoples. Free recipes are available. ANCIENT EGYPT: Half-hour tour of our Egyptian collection includes an explanation of the "how's" and "why's" of mummy-making. THE WORLD OF ANIMALS: Touchable animal specimens on display. Learn how animals are prepared for exhibits. For specific programs and locations, inquire at entrances.

THE ANCIENT ART OF WEAVING

WEAVING ON A TWO-HARNESS, HANDCRAFTED MEXICAN FLOOR LOOM, demonstrated by members of the North Shore Weavers' Guild every Monday, Wednesday, and Friday, 10:30 - 11:30 a.m., and 12:00 - 1:00 p.m. On Mondays, Oct. 6 and 20, the demonstrations include spinning. South Lounge, second floor south.

FALL JOURNEY FOR CHILDREN

"PLANTS THAT GROW ON OTHER PLANTS," a free, self-guided tour focusing on the museum's botany halls. All children who can read and write are invited to participate. Journey sheets in English and Spanish are available at the information booth. Bring pen or pencil.

SPECIAL PROGRAMS FOR GROUPS

MONDAY THROUGH FRIDAY, ALL YEAR (except Christmas and New Year's Day) free educational programs are offered to preregistered groups of ten or more. Your child's teacher or community group leader may be interested in the many educational opportunities available at the Field Museum. For a free educational program brochure, please write: Group Programs, Field Museum.

SPECIAL-INTEREST MEETINGS

Oct. 3, 8:00 p.m.	Chicago Anthropological Society
Oct. 7, 7:30 p.m.	Kennicott Club
Oct. 8, 7:30 p.m.	Windy City Grotto, National Speleological Society
Oct. 12, 8:00 p.m.	Chicago Shell Club
Oct. 14, 7:00 p.m.	Chicago Nature Camera Club
8:00 p.m.	Chicago Mountaineering Club
8:00 p.m.	Chicagoland Glider Council
Oct. 21, 7:30 p.m.	Chicago Audubon Society

COMING IN NOVEMBER

MAN IN HIS ENVIRONMENT, opens to the public Nov. 9 (members' preview Nov. 8). This compelling new permanent exhibition explores, through a series of graphic, three-dimensional, and audiovisual experiences, the impact of our society on the natural processes of life.

"ENVIRONMENT: THE SUM OF ITS PARTS," A film series in conjunction with the Man in His Environment exhibit, offered November 9, 1975 through March 28, 1976. Topics are: "Ecosystems" (November), "Adaptations for Survival" (December), "The Vanishing Wilderness (January), "Human Alternatives" (February), and "The Question of Tomorrow" (March). (See p. 18 for details.) Viewings are at 11:00 a.m. and 1:00 p.m. on Fridays, Saturdays, and Sundays in the Meeting Room, second floor north.

OCTOBER HOURS

THE MUSEUM opens daily at 9:00 a.m. and closes at 5:00 p.m. every day except Friday. On Friday, year-round, the museum is open to 9:00 p.m. Food service areas are open weekdays 11:00 a.m. to 3:00 p.m., weekends to 4:00 p.m.

THE MUSEUM LIBRARY is open 9:00 a.m. to 4:00 p.m., Monday through Friday. Please obtain pass at reception desk, first floor north.

MUSEUM TELEPHONE: 922-9410

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November
1975

Field Museum of Natural History Bulletin

Field Museum of Natural History Bulletin

November, 1975
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COVER

Detail of pen-and-ink drawing by Kinuko Y. Craft, Chicago artist. The complete drawing depicts six principal biomic types: tundra, woodland, grassland, desert, tropical jungle, and marine. The segments showing tropical jungle and desert are reproduced on the front and back covers, respectively. Pages 10-11 show tundra, woodland, and grassland. The drawing, enlarged as a mural, is on view in area 6 of the Man in His Environment exhibit, opening to the public November 9.

PHOTO CREDITS

Photos on pages 13-18 by Alan Levine; all others by Field Museum staff.

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Man In His Environment

A New Exhibit that May Disturb and Motivate as well as Inform

Man in His Environment will be open exclusively to Field Museum members and their guests during the entire day of Saturday, November 8. On the following day, Sunday, November 9, the exhibit will be opened permanently to the public.

By David M. Walsten

Man in His Environment, Field Museum's Bicentennial exhibit, could well be the most significant—and most disturbing—exhibit mounted at the Museum since the institution first opened its doors more than eighty years ago. The exhibit is unique in that it integrates—as facets of ecology—the separate disciplines of zoology, botany, and anthropology; but the most significant aspect of Man in His Environment is that it does not merely *inform*, it asks the visitor to *consider the implications for earth's future*. How is the quality of life on our planet changing? What are the consequences for man if he does not choose wisely among the options that are yet open to him? The ultimate hope of those who conceived the exhibit is that the visitor will come away from it with a heightened concern not only for present realities, but for future probabilities, and that he will be motivated to take individual action toward a solution of our environmental dilemma.

The fundamental concepts of the exhibit were first elucidated in *Man in the Environment* (Knopf, 1975),* a book by Ruth Moore. The purpose of this book, in fact, was to establish a conceptual basis for the exhibit, and Ruth Moore's explication of man's environmental dilemma is both lucid and compelling.

Exhibit Areas

The exhibit space for Man in His Environment is the 8,000-square-foot area of Hall 18, on the first floor, which has been named the "Ray A. and Joan M. Kroc Hall." Mr. and Mrs. Kroc were major donors to the funding of the exhibit.

In Area 1 (see diagram, p. 5), *Sphere of Life—Earth's Diversity*, a large, multifaceted sphere briefly characterizes each of five biomes, or types of environment. In Area 2, *Ecological Realities—Natural Laws at Work*, Theater I shows a 15-minute, continuous-loop, color film produced exclusively for the exhibit. The film explains how mineral nutrients are cycled, how energy

*Available at the Field Museum Book Shop.

◄ *Portion of salt marsh diorama in area 3.*

flows through a food chain, and how animal populations are controlled.

Area 3, *Salt Marsh Ecology—Natural Laws at Work in a Salt Marsh,* features a central diorama which may be viewed from any of four sides. A salt marsh—a reproduction of that on Sapelo Island, Georgia—is the subject of the diorama, with many of the vertebrate and invertebrate inhabitants of the marsh, as well as plant life, represented: several bird species, raccoons, butterflies, mollusks, and crabs. The diorama is a visualization of principles and processes discussed in the film shown in Theater I.

Area 4, *Toolmaker's Progress—The Increasing Complexity of Our Food Production Tools,* features a life-size sculpture of a lion and a primitive man, both feeding at carcasses of two wild pigs—one predator eating by means of claws and teeth, the other aided by a stone tool. It shows man's kinship with animals, but reveals that he is different by virtue of his culture, represented by the tool. (*See "Anatomy of a Sculpture," p. 6.*) The area continues with a representation of the development of culture in three episodes through the use of a prehistoric stone chopper, a medieval plow, and a modern plow.

Area 5, *The Choice Is Ours—Our Impact on the Earth,* consists of Theater II, which shows a 20-minute, continuous-loop, color film. The film deals with the present status and alternatives for the growth of the human population, the use of natural resources, and the disruption of natural checks and balances by our present agricultural practices. Questions concerning the implications of these alternatives for our social institutions are posed.

Area 6, *Message from Other Cultures,* is a circular room, the walls of which are dominated by an eight-foot-high mural (two segments of which are reproduced on this month's *Bulletin* cover). The mural, created by Chicago artist Kinuko Y. Craft, depicts six of earth's major biomic types: tundra, temperate forest, grassland, desert, tropical jungle, and marine. Also on view in Area 6 are a selection of artifacts from pre-industrial cultures. These may suggest that there are certain alternatives for modern man in his attempt to relate harmoniously to the environment.

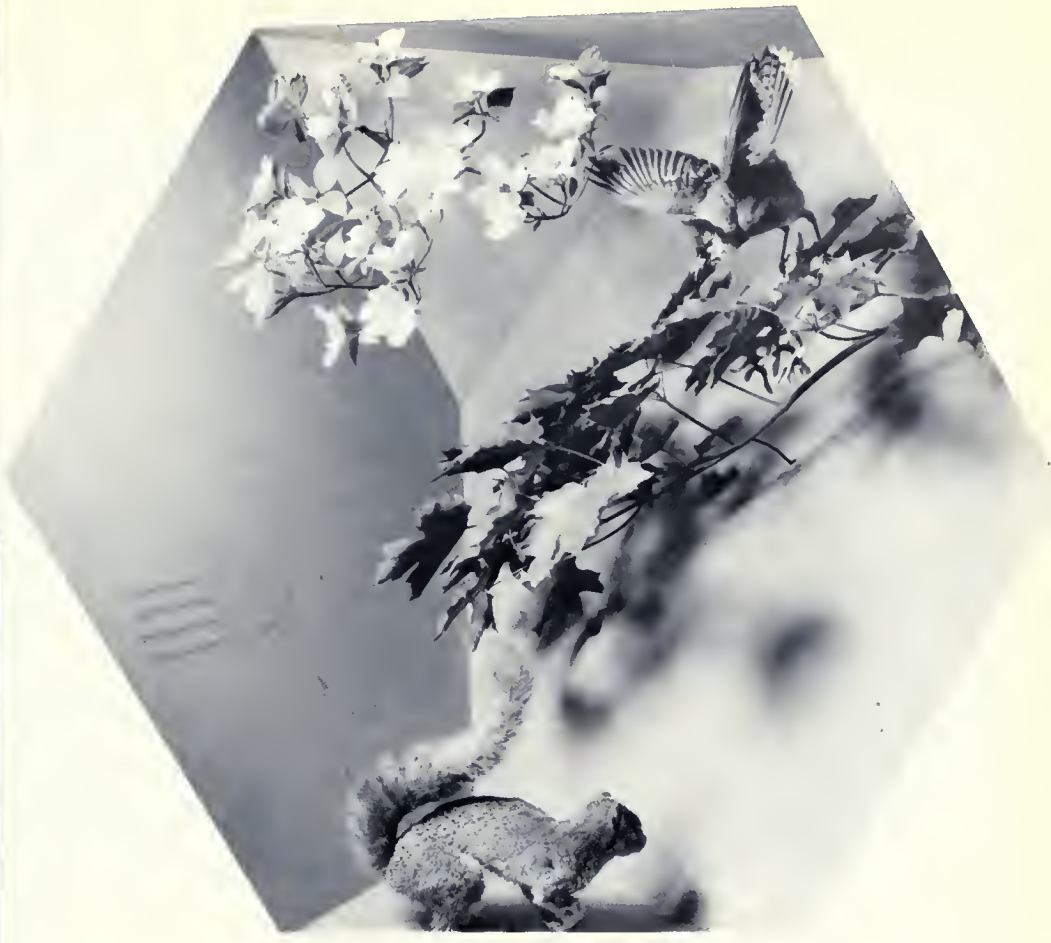
Education Programs

The new exhibit is but one facet of an ongoing Man in His Environment program, which includes activities in the Chicago area as well as a traveling exhibit. Locally, the program offers a series of environmental films (for November showings at Field Museum see "November at Field Museum," inside back cover), lectures, field trips, workshops, school programs, museum kits (for school classrooms and other nonprofit community organizations), various printed materials, and courses (including topics such as winter botany, land use, amateur geology, etc.). Additional information about local programs is available by writing or calling the Department of Education, Field Museum.

Traveling Exhibit

A traveling Man in His Environment exhibit, developed by the Field Museum staff and to be circulated by the Smithsonian Institution Traveling Exhibit Service, covers most of the subject matter of the two films shown at the Field Museum exhibit. It is de-

◄ *Portion of salt marsh diorama in Area 3.*

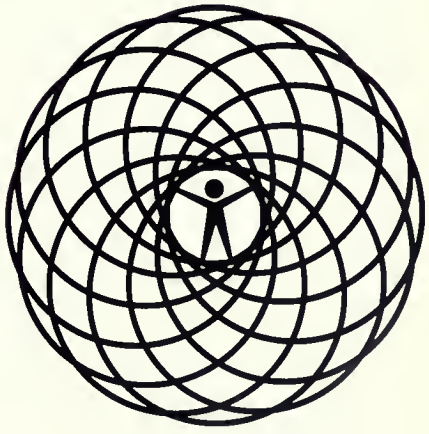


A grouping in Area 1, with specimens of fox squirrel, blue jay, sugar maple, and dogwood.

signed for general visitors to small and medium-size museums throughout the United States.

Funding

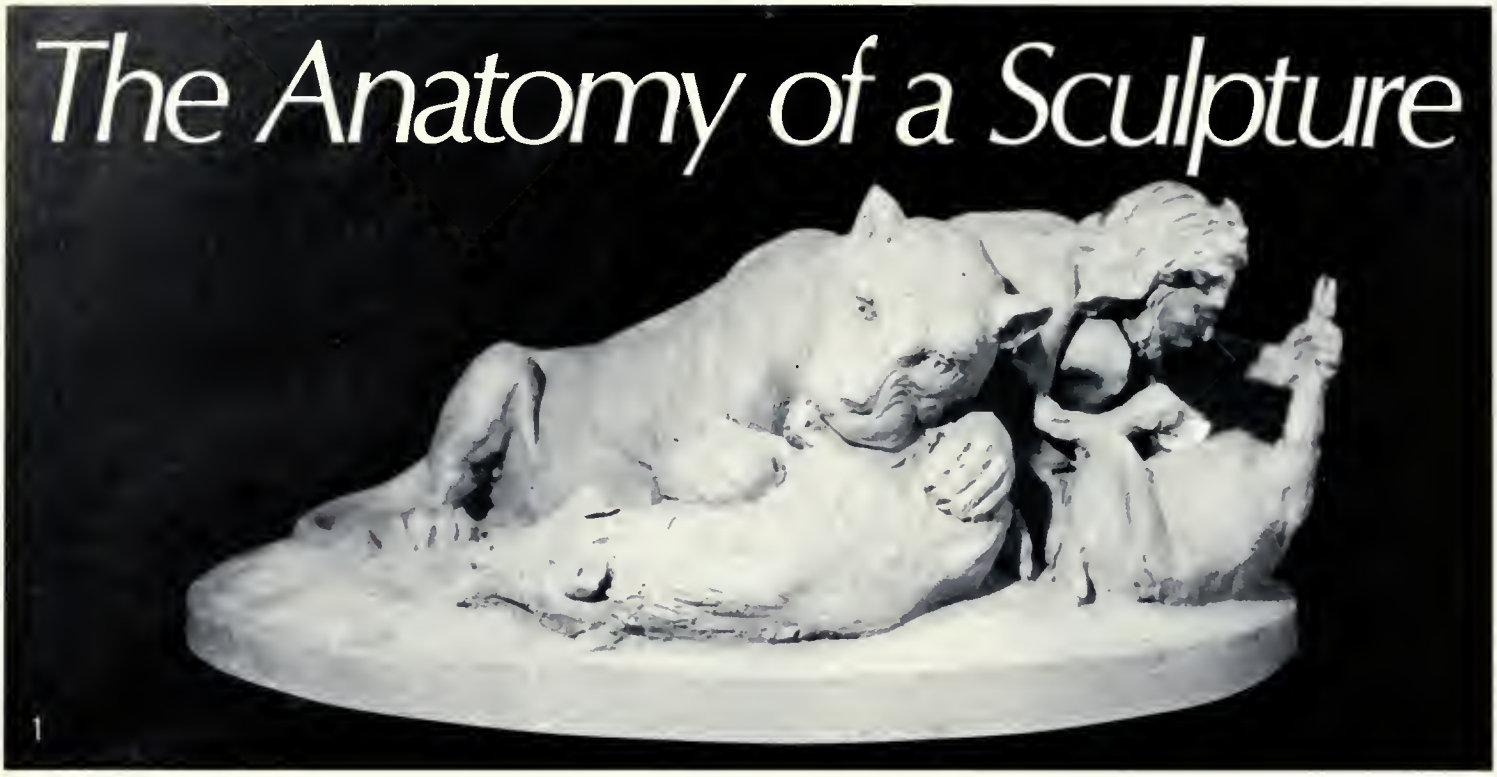
The Man in His Environment project was made possible by a major gift from Mr. and Mrs. Ray A. Kroc and grants from National Endowment for the Humanities, National Science Foundation, Field Foundation of Illinois, and The Charles E. Merrill Trust; funding for certain construction elements was also provided by the Chicago Park District and by the Field Museum Capital Campaign.



Man in His Environment symbol.

◄ *Floor plan of Man in His Environment exhibit*

The Anatomy of a Sculpture



1

By William Pasek

The curious thing about even the most simple work of art is that it belies the complexity of its creation. The original sculpture in the Man in His Environment exhibit is a good example.

Early in the development of the exhibit design, we decided that a dramatic sculpture would be the medium to introduce man, the unique animal. The sculpture would occupy a prominent place in the critical transition area where the focus of the exhibit shifts from natural systems to man and his relationship to the world around him. The important concept we wanted to illustrate is that, although man is not independent of the natural laws that govern all life, his culture distinguishes him from other animals.

To exemplify this concept we advanced the idea of showing a man and an animal engaged in the same activity. The project was assigned to Martin Wanserski, Field· Museum preparations sculptor (now a member of the art department faculty at the University of South Dakota). Wanserski developed the idea into alternate approaches and sculpted three preliminary models of the subject in clay.

The chosen version, shown above, depicts a lion and a primitive man tackling the universal problem of getting food. The lion is using its teeth to tear the flesh of a wild pig, while at its side, the man is cutting the carcass of another pig with a crude stone tool. The torsos of the man and lion are joined, illustrating their common origins, while the ways they are attacking their food illustrate their differences.

One result of man's special abilities is represented here in the various steps taken to create this sculpture. The life-size figures were first sculpted in clay by Wanserski, and finally rendered into polyester resin with the aid of John Cannon, acting chief preparator, and Kevin Williams, preparator.

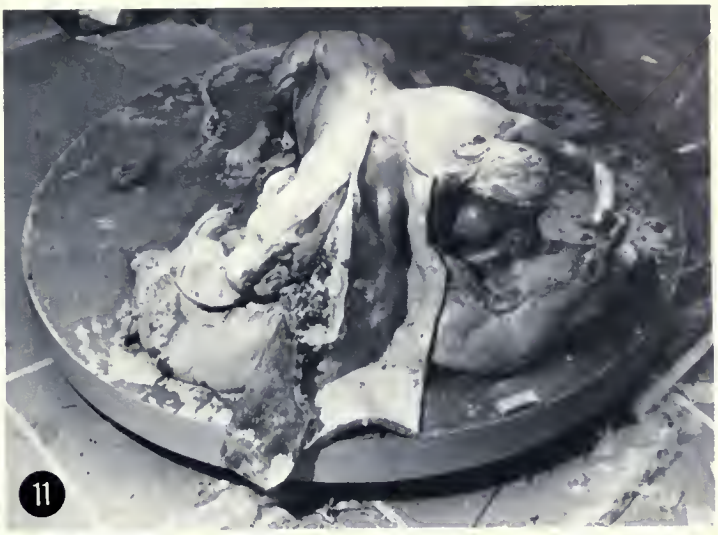
2

William Pasek is acting chairman of the Department of Exhibition.

(1) Preparatory to executing life-size sculpture, Marty Wanserski makes ¼-size clay maquette, or model. (2) Armature, or metal spine, supports clay of full-size sculpture. (3) Finished clay sculpture. (4) Rubber molding compound is brushed onto clay form in sections. (Con't on p. 8)

(5) Wanserski applies fiber glass jacket over rubber mold. (6) After fiber glass has set, it is removed in sections, leaving rubber mold. (7) Rubber mold, bearing detailed impressions from clay base, is peeled away from clay. Clay base is discarded. (8) Rubber mold sections are fitted back into corresponding sections of fiber glass. (9) The latter sections provide support as several coats of polyester resin are applied to inner surface of rubber mold. (10) The reinforced sections of polyester resin are assembled. (11) Fiber glass jacket is removed and rubber molding peeled away, leaving polyester resin casting. (12) Surfaces are sanded and finished. (13) Color is applied. (14) The finished sculpture.

10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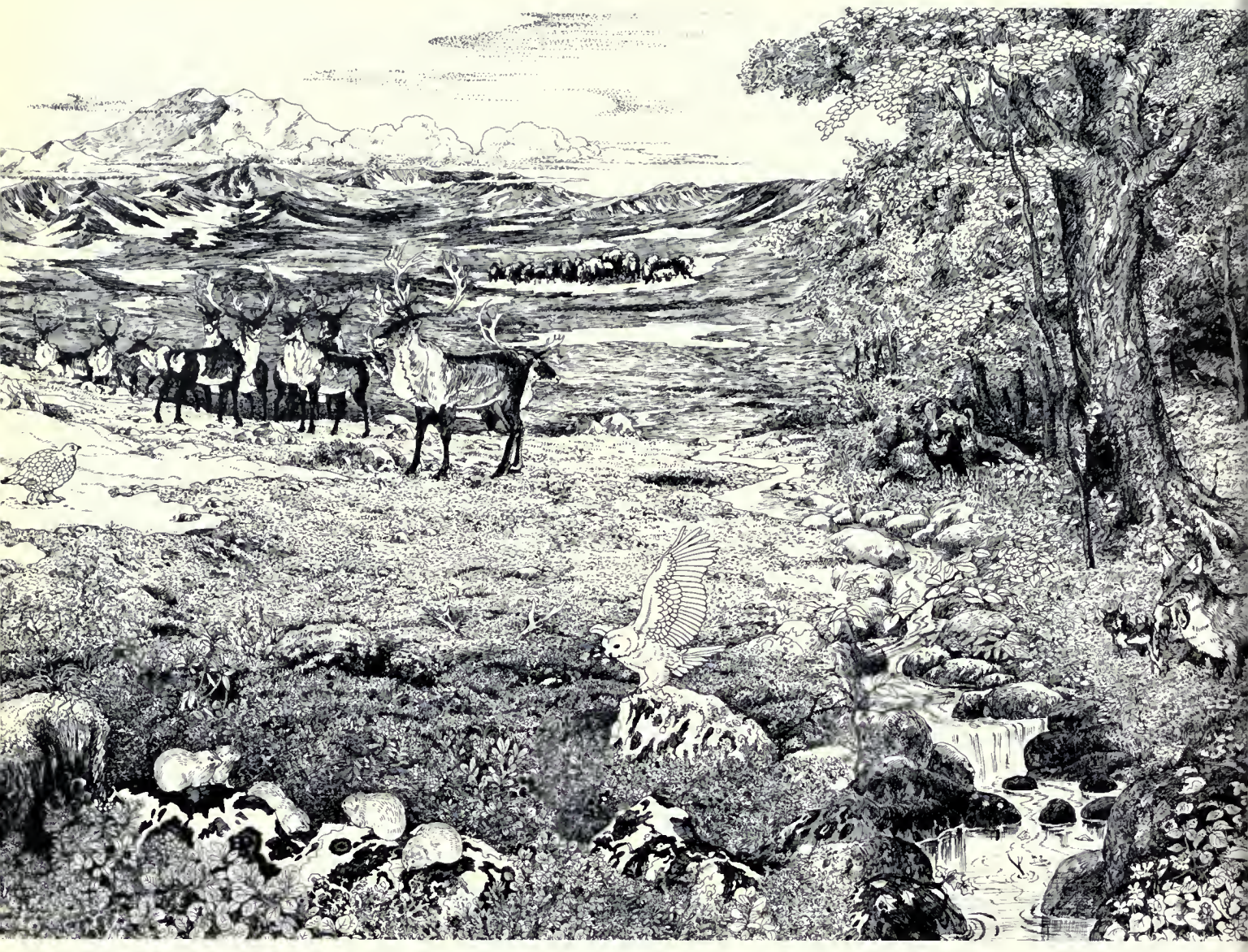

Three of earth's major biomes — tundra, deciduous forest, and grassland — as depicted by Chicago artist Kinuko Y. Craft. The segment shown here is part of a drawing which also depicts desert, jungle, and marine biomes. (The desert and jungle biomes are reproduced on this month's *Bulletin* cover.) The entire work — 48 feet long and nearly 8 feet high — is on view as a mural in area six of the newly installed *Man in His Environment* exhibit. Mrs. Craft executed the original work in pen and ink. The drawing was then enlarged photographically to produce the mural. Copyright © 1975 by Field Museum of Natural History.

field briefs

Leon L. Pray putting the finishing touches on his model of a mesembriornis, *or terror bird, a prehistoric species.*

Leon L. Pray, 1882-1975

"A genius," was the way Clifford C. Gregg, former director of Field Museum, once described Leon L. Pray, distinguished artist and taxidermist at Field Museum from 1901 to 1947. Mr. Pray died Sept. 18 in Aurora, Ill., at the age of 93. During his near-half-century at Field Museum Mr. Pray mounted hundreds of animal specimens which are still on exhibit at Field Museum. But he was also a highly creative technician who invented a number of devices and processes for mounting and preserving animals. Chief among these were borax solution mothproofing (replacing arsenic and corrosive sublimate), fish models in place of mounted fish skins, a hollow, built-in mannikin for mounting small mammals, and mounting large mammals or mannikins without the use of clay models or plaster casts.

Mr. Pray was born at Dowagiac, Mich., in 1882, and attended the Art Institute of Chicago. He first came to the Field Museum (then located in Hyde Park) in 1901, at the age of 19, and was to remain there almost without interruption until 1947, when he retired at the age of 65. He wrote a large number of books and magazine articles on animal mounting procedures and, in addition to his work in the Museum, participated in a number of expeditions, including trips to various parts of North America and to the Bahamas. Mr. Pray is survived by a daughter, Mrs. Ellen P. Goewey, and two grandchildren.

Voris Returns from Southeast Asia

After ten months of collecting and related research on the sea snakes of Southeast Asia, Harold Voris, assistant curator of reptiles and amphibians, has returned to Field Museum. (See "Sea Snakes: A Field Report," July/August *Bulletin*.) The main purpose of Voris's trip was to learn more about the geographic and ecological distributions of the venomous marine snakes of Malaysia and to investigate phenomena such as migration, reproductive cycles, and food habits. During the trip he was also able to collect more than 3,000 marine and estuarian snakes representing 17 species. One of the species is new to the Museum collection and several of the species are now, for the first time, represented with adequate study samples.

The trip also included a three-month investigation of the reptiles and amphibians of a Sumatran rain forest. This yielded a collection of more than 900 specimens of frogs, toads, turtles, snakes, and lizards and a species total of about 70. The Sumatran specimens are a particularly valuable addition to the Museum's collection, since no extensive collecting has been done in that region.

Dr. Voris was assisted on the trip by Mrs. Voris. Lim Boo Liat, of the Institute for Medical Research, at Kuala Lumpur, Malaysia, collaborated with the Vorises. Funding was provided in part by the Allen-Heath Foundation, the Philip K. Wrigley Marine Biological Research Fund, and the Ray A. Kroc Environmental Fund.

Kennicott Club

Forty-five years ago the Kennicott Club was founded to promote the study of natural history; it was names after Robert Kennicott (1835-1866), the Chicago pioneer naturalist. The club sponsors lectures by members and guests and regularly meets at Field Museum on the first Tuesday of each month at 7:30 p.m. Persons interested in the subject of the evening's talk are cordially invited to attend.

At the November 4 meeting, Leslie Freeman, associate professor of anthropology at the University of Chicago, will speak on "The Training of the Professions in the People's Republic of China — an Anthropologist's View." Dr. Freeman recently returned from a visit to mainland China. At the December 2 meeting Robert Johnson, associate curator of fishes at Field Museum, will speak on "A Profusion of Predators: Aspects of the Biology of Deep-Sea Fishes."

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Total distribution	23,313	23,685
Office use, left over	3,287	3,215
Total	26,600	26,900

I certify that the statements made by me above are correct and complete. — *Norman W. Nelson*, Assistant Director, Administration.

Viewed from a cave — typical "tortuga grande" country in Chihuahua, Mexico. The author, left, visits the site with Mexican guide.

Man and Tortoise

The Search for a Little-Known Mexican Reptile and Its Curious Relationship to Man

By Ray Pawley
Photographs by Alan Levine

A relatively late arrival in the zoological literature was the scientific description of the yellow-margined, or bolson, tortoise (*Gopherus flavomarginatus*), of north central Mexico; it was not officially described until sixteen years ago.[1] The failure of science to record the species until so recently is remarkable on a number of counts: The

Ray Pawley is curator of birds and reptiles at Brookfield Zoo.

◄ *A large specimen of* Gopherus flavomarginatus *— "la tortuga grande" of north central Mexico.*

Foothills near Hacienda de los Remedios

habitat of the yellow-margined has virtually no natural cover and the terrain offers few places for a ten-pound, sixteen-inch animal to hide; it is not especially wary, and neither its markings nor its coloring serve as good camouflage; nor is it nocturnal in habit. Furthermore, some burrow "colonies" of the tortoise are within easy view of a much-traveled highway.

On the other hand it would have been easy, without further investigation, to surmise that any tortoise in the area belonged to one of two other gopher tortoise species—the desert tortoise (*Gopherus agassizii*) or the berlandier tortoise (*G. berlandieri*), both of which occur in the Southwest.

Perhaps even more startling than its delayed discovery is the tortoise's continued survival in a singularly hostile environment. This may be due less to the animal's natural tenacity than to a simple

Señora Dado entices tortoise with bits of clover.

conservation program practiced for unknown generations by the scattered community of humans who eke out a living in that barren region.

During a three-way conversation with Monroy and Pescal, I mentioned some discarded carapaces, or back shells, of the yellow-margined that I had seen on a nearby refuse heap. Monroy said that, contrary to my suggestion, the animals were not rare; but their colonies, he said, were widely separated. Local residents, I was told, sometimes ate the animals. The lieutenant then produced a strapping eight-pound tortoise that was almost ready to be dumped into the stew kettle. With some reluctance, Monroy agreed to part with the animal in exchange for several pesos.

Several years after its formal discovery, photographer Alan Levine and I were in the city of Torreon, in the state of Coahuila, asking local residents where we could find specimens of *G. flavomarginatus*. Our two-week search for this

"...we were shortly to discover two baby tortoises, each no larger than a hen's egg."

species was part of an extensive "Vampire Bat Expedition" that carried us across the length and breadth of Mexico in search of bats and other mammals, birds, reptiles, and plants for Brookfield Zoo.[2] Mexico's Department of Conservation kindly granted us permission to collect specimens for exhibition and captive breeding purposes.

In Torreon, a physician who was also an expert on the local natural history, Dr. Manuel Medina G., put us in touch with Manuel "Pescal" Galvoza Lora, a bilingual guide. Pescal, in turn, introduced us to acquaintances who knew of *la tortuga grande* first-hand, and he patiently interpreted for us an endless exchange of questions and answers about the reptile and its lifestyle.

Later he guided us 100 miles northwest into the state of Chihuahua, where we turned off the highway to travel yet another 30 axle-torturing miles. Our destination was a remote army post, *Hacienda de los Remedios*, where we were greeted by the commandant, Lt. Florez Monroy. Since Monroy's assignment to the lonely post several years earlier, we were only the second party of gringos to come that way, and we received the full measure of Mexican hospitality: horseback riding, visiting a cave with ancient wall paintings, sampling bottles of Monroy's vintage *mescal* (some fortified with insects and guaranteed to restore sexual powers), and luxuriating in a hot springs—hence the name "House of Remedies."

Our rescued tortoise was not at all shy, and declined to retract his head even when lightly tapped. The yellow-edged carapace and plastron, or lower shell, was unusual (compared to those of other species) in that they bore no blemishes or worn surfaces at all; but the tortoise's most arresting feature was its gleaming yellow eyes.

Monroy went on to say that the local residents were very solicitous of their hard-shelled friends and careful not to over-harvest them, culling only a few each year for their food supply. At approximately one- or two-week intervals a pickup truck loaded with fresh greens would be driven a circuit of several miles across the desert, and some of the load dropped off at each of various tortoise colonies. In return for their largess, the provisioners extracted payment from time to time by selecting a big, healthy tortoise for their own dinner tables.

To maintain this unusual conservation program, the local people imposed no licenses or controls upon themselves and there was no poaching, since "everyone knew everyone" and a snitched tortoise would soon be common gossip.

Here, then, was a system of cultivation and cropping of a wild animal that had long ago been worked out according to an efficient, albeit simple set of rules. In all likelihood, the community's practice—comparable to programs in midwestern United States of providing food in winter for deer—long antedated sophisticated game management systems. On the basis of evidence offered by refuse left centuries ago in local caves by pre-Columbian Indians, Dr. Medina speculated that the tortoise has been a human food staple there for centuries; and it is not difficult to assume that even at that distant time, a kind of symbiotic relationship existed between *Homo sapiens* and *Gopherus flavomarginatus*. If the yellow-margined has indeed come to depend on man for food, it is most assuredly the only reptile that continues to survive under such remarkable patronage.

Back in Torreon, we visited the home of the Dado family, where a pair of yellow-margineds had been domiciled as pets for more than two years. These tortoises, too, were destined for the family dinner table, but fortunately for us (to say nothing of the tortoises), that event seemed to be one of perpetual postponement.

The animals had dug two burrows some distance apart, with entrances at the bottom of the courtyard wall. They extended beneath it, passed under the sidewalk outside the wall, and presumably extended out under the street.

At midday, when we arrived, the tortoises were deep inside their burrows. They would emerge, we were told, "perhaps this evening, perhaps in two or three days, perhaps in a month." However,Señora Dado boasted that she was able to call them from their burrows any time she wished. To demonstrate, she placed a handful of fresh clover in front of the two entrances. Indicating for us to remain at a distance, she began tapping the ground and softly calling.[3]

Adult yellow-margined tortoise in excavated burrow.

Excavated tortoise burrow

After several minutes, Señora Dado whispered that a tortoise had approached to about three feet inside the entrance. The animal would come no closer, she explained, because it knew that strangers were present. Peering into the spacious burrow, we could indeed make out the hulk of a large tortoise, turned at an angle as though pondering whether it was safe to come further. Inserting a snake hook into the hole, I got a hold on the animal (a female) and gently pulled it out. Moments later I also got the male.

For me, the thrill of acquiring the two superb specimens was made even more meaningful by the opportunity to observe first-hand this example of interspecific behavior between man and tortoise—the animal's response to Señora Dado's calling and tapping. But the best was yet to come; we were shortly to discover two baby tortoises, each no larger than a hen's egg, also living in the burrows. There is no question in my mind that we were the first outsiders ever to see a baby yellow-margined tortoise. The Dados graciously presented the tiny creatures to us as a gift, even though they had been special pets of the Dado children, and one was painted pink! (The latter died just a few days later, after we carefully flaked off the paint.) The little ones had apparently hatched from eggs laid in one of the burrow chambers. Unfortunately, the Dados could tell us nothing about the number of eggs laid, their size, exactly where they had been laid, or the period of incubation; nor had they witnessed any courtship or mating behavior. Much, therefore, was left to our speculation.

Not until we later arrived at an actual tortoise den site, in the desert, were we able to make further observations about the animals' lifestyle. With Pescal as "navigator" and myself at the wheel of our station wagon, we bounced over another stretch of gravelly, roadless desert. Finally, Pescal pointed to a light-colored patch of gravel a few hundred yards distant. Its pale color, he explained, indicated that it had been freshly exposed and was not sufficiently weathered to match the prevailing gray-brown of the surrounding area. We could hardly contain our excitement, for here, at the base of a slope, was a half-acre cluster of perhaps twenty tortoise burrows, with signs of recent activity. The burrows were mostly six to twelve feet apart—a proximity in marked contrast to the interval of many miles between colonies.

Dr. Medina subsequently informed us that an underground communal network is formed by the burrows of the yellow-margined tortoise, and that a single entrance may be used by any number of them. But our excavation of one burrow revealed no such network, although the tunnel forked and reforked for a total length of 22 feet, terminating in four dead ends. Its structure differed markedly from that of the gopher tortoise, which is usually unbranched. Sloping gradually downward, the tunnel penetrated several feet into the hillside, with the terminal branches at least six feet below the surface.

In the case of the gopher tortoise, the burrow diameter is only slightly wider than the animal's shell, and the shells of adults always show some wear around the edges. The yellow-margined, on the other hand, enlarges its burrow so that there is ample room for the animal to turn around or even to stand on all fours, with several inches of clearance above and to the sides; its shell rarely shows any sign of wear. Perhaps stories that came to us of gigantic yellow-margineds ("larger than a saddle") were sheer speculation based on the size of burrow entrances rather than on specimens that had actually been seen.

Among other tortoise species, the presence of juveniles is often indicated by narrow burrows, but all burrows in the colony we studies were at least six inches wide—considerably larger than what might be expected for tiny baby tortoises. In the case of gopher tortoises it is not unusual to find very small burrows in the company of large ones, indicating that even the very young animals dig their own burrows. It is tempting to speculate that perhaps yellow-margineds lay their eggs in an end chamber and that the young use the parents' burrow until they are larger and able to dig their own. Unlike the cramped quarters of the gopher tortoise, there would be ample room for adult and young yellow-margineds to share the space, moving around or even crawling over each other. The absence of small burrows may not necessarily mean a reproduction decline.

Standing on a hilltop overlooking the colony, it was obvious to me that an expanse of water had once covered many square miles of what was now desert. A remnant of the slowly vanishing lake could still be seen some miles to the north. Why yellow-margineds selected this site for their colony was of special interest to us. Curiously, they had not built on the desert (dry lake) floor, where they would have been closer to the

edible ground cover which sprouts forth after one of the infrequent cloudbursts. Perhaps some lingering instinct prevented their constructing burrows on a dry lake floor which, generations before, had been subject to flooding and inundation. Nor did they choose to build higher on the slopes, which would have placed them closer to shrubs, also edible. Their chosen site seemed to place them a few hundred yards from either available food source.

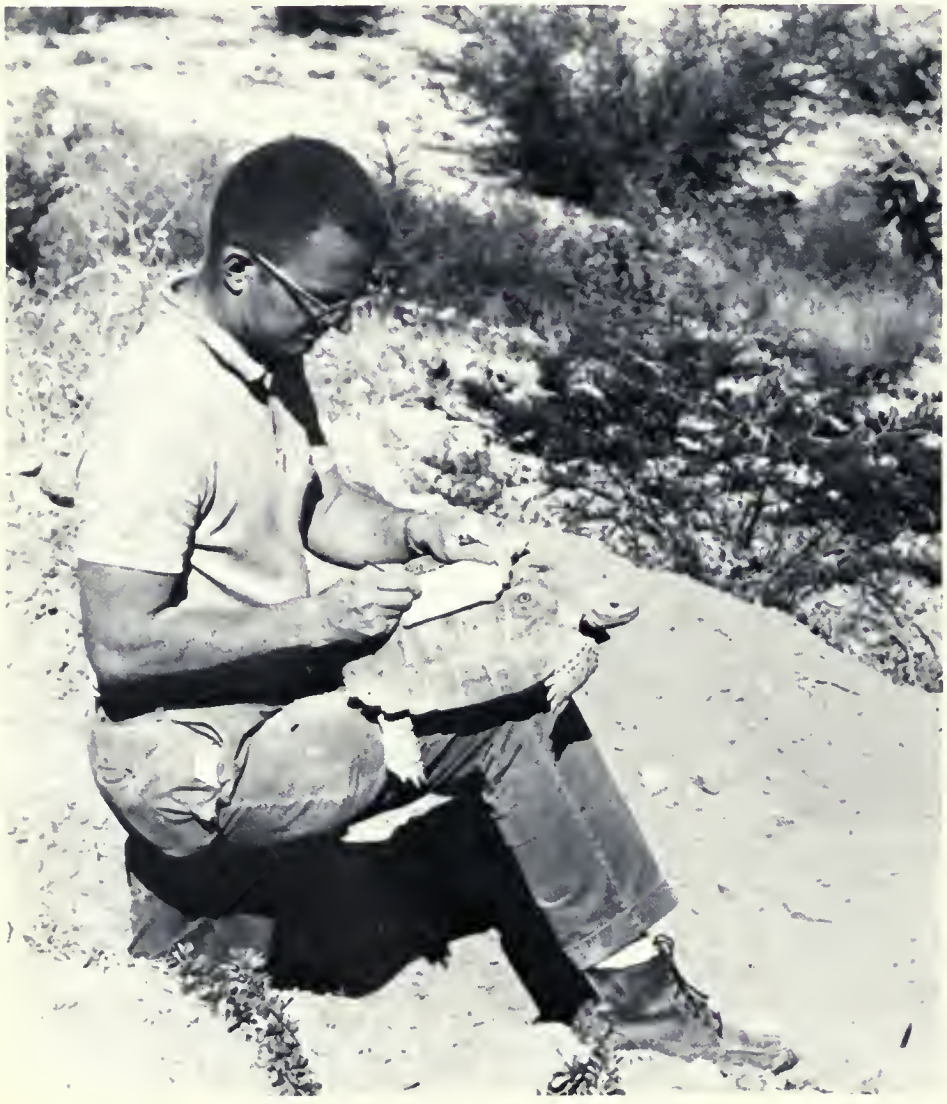
The adaptation of the yellow-margined tortoise to a progressively drier environment is not unique; the closely related desert tortoise of our own Southwest has also made remarkable adjustments. Tortoises can go for months without food, thanks to a low metabolic rate; and their exceptionally thick skin is an effective protection against loss of body moisture.

Additional protection against the burning heat of summer days and the freezing cold of winter nights is provided by the yellow-margined's burrow. In fact, the tortoises rarely emerge from their burrows, according to our informants at Hacienda de los Remedios, but spend most of their lives underground. Being vegetarians, they are inconvenienced less by food scarcity in dry periods than are meat-eaters. Moisture from the green plants they eat is ample for their needs, and like certain other tortoise species, yellow-margineds may never require a drink of water in an entire lifetime. We were told that the tortoises would remain relatively dormant during prolonged spells of heat and cold, surfacing only for brief periods at sunrise or sundown, particularly during a heavy dew or during one of the infrequent rains. Judging by the habit of captive yellow-margineds of rapidly browsing on the nearest available greenery, it is likely that they also do this in the wild state in order to keep their outside time to a minimum.

There are a great many questions about the yellow-margined that remain unanswered, and a general natural history survey of the species is now urgently needed; we should learn more about its diet, subterranean lifestyle, activity cycles, and the animal's territorial and reproductive behavior. Questions about population changes and the extent to which traditional management practices are affecting their numbers need answering, and comparisons should be made between tended and untended colonies.

It is gratifying to see the kind of regard the Mexicans of this region have for the yellow-margined tortoise, even though their ultimate motives are in their own interest. In all likelihood, the animal would already be extinct were it not for their concern and solicitude. But the tortoises may be waging a losing battle. It would be especially sad if this species long associated with man, yet only recently "discovered," were to soon become extinct.

Carapace of tortoise freshly removed from excavated burrow is convenient writing desk



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[1] By John Legler, in *University of Kansas Publications, Museum of Natural History*, Vol. 11, No. 5, pp. 335-43, April 24, 1959. Specimens had been collected, but not formally described, as early as 1918, when Elswood Chaffee collected a specimen which is now in the collection of the U.S. National Museum. In 1888 A. Duges described two specimens which he believed to be the gopher tortoise (*G. polyphemus*), restricted to southeastern United States. The characters he described, however, generally agree with those of *G. flavomarginatus*.

[2] Sponsored by the Chicago Zoological Society, with transportation provided by the former Ted Borak Pontiac dealership, of Blue Island, Ill.

[3] Tortoises are known to have good hearing. While in their burrows they can also detect the presence of other animals through vibrations in the ground.

NOVEMBER at Field Museum

NEW PROGRAMS AND EXHIBITS

"MAN IN HIS ENVIRONMENT" EXHIBITION

A COMPELLING NEW EXHIBITION, "MAN IN HIS ENVIRONMENT," opens to the public November 9 (members' preview November 8). This dramatic, permanent exhibition explores, through a series of graphic, three-dimensional, and audiovisual experiences, nature's magnificient system of checks and balances and the impact of man and society on environmental processes. The exhibit also raises serious thought-provoking questions about man's role in preserving the quality of life on our planet.

FILM SERIES

"ENVIRONMENT: THE SUM OF ITS PARTS," offered now through spring 1976. The November series, "Ecosystems"—Africa to the Arctic, a marsh to a prairie, shows a variety of natural communities and the effect of environmental problems on their built-in system of checks and balances. Films are shown at 11:00 a.m. and 1:00 p.m. in the Meeting Room, second floor north.

Nov. 9, 14, 15, 16 "Mzima: Portrait of a Spring"
Nov. 21, 22, 23 "High Arctic Biome" and "Billion Dollar Marsh"
Nov. 28, 29, 30 "Survival on the Prairie"

CONTINUING PROGRAMS AND EXHIBITS

SPECIAL BOTANICAL ILLUSTRATIONS EXHIBIT

TWO HUNDRED YEARS OF BOTANICAL ILLUSTRATIONS FROM KEW GARDENS, ENGLAND, includes 123 plant illustrations ranging from mushrooms to orchids. Pen-and-ink and watercolor are the dominant media. Hand-colored lithographs and several etchings of Kew Gardens are also included. Three-dimensional plant models from the Field Museum's outstanding collection add their own form of illustration. Live plants and eighteenth century music, played continuously, further enhance the beauty of the exhibit. Hall 9, through November 16.

FILM/LECTURE SERIES

"MAN'S ONE WORLD," a film/lecture series on the impact of ecological disturbance upon traditional cultures. Anthropologists will discuss the films and answer questions about these pressures and changes. Ground floor lecture hall, Fridays at 7:30 p.m., repeated Saturdays at 2:30 p.m.

Nov. 8, 9: "The Village" (Saturday, November 8 members only)
Nov. 14, 15: "Ishi in Two Worlds"
Nov. 21, 22: "Sky Chief"

SATURDAY DISCOVERY PROGRAMS

TOURS, DEMONSTRATIONS, AND PARTICIPATORY ACTIVITIES are offered continuously, every Saturday, 11:00 a.m. to 3:00 p.m. Topics vary, but often include: DINOSAURS: Clay modeling in the Hall of Dinosaurs. Make a dinosaur to take home. EARLY MAN: A tour that traces major trends in man's physical and cultural evolution. NATIVE AMERICAN FOODS: Try free samples of foods from Hopi, Navajo, and Zuni peoples. Free recipes are available. ANCIENT EGYPT: Half-hour tour of our Egyptian collection includes an explanation of the "how's" and "why's" of mummy-making. THE WORLD OF ANIMALS: Touchable animal specimens on display. Learn how animals are prepared for exhibits.

For specific programs and locations, inquire at entrances.

WEAVING DEMONSTRATIONS

THE ANCIENT ART OF WEAVING on a two-harness, handcrafted Mexican floor loom, demonstrated by members of the North Shore Weavers' Guild every Monday, Wednesday, and Friday, 10:30 - 11:30 a.m. and 12:00 - 1:00 p.m. On Mondays, November 3 and 17, the demonstrations include spinning. South Lounge, second floor.

FALL JOURNEY FOR CHILDREN

"PLANTS THAT GROW ON OTHER PLANTS," a free, self-guided tour focuses on the museum's botany halls. All children who can read and write are invited to participate. Journey sheets in English and Spanish are available at the information booth. Bring pen or pencil.

SPECIAL PROGRAMS FOR GROUPS

MONDAY THROUGH FRIDAY, ALL YEAR (except Christmas and New Year's Day) free educational programs are offered to preregistered groups of ten or more. Your child's teacher or community group leader may be interested in the many educational opportunities available at the Field Museum. For a free educational program brochure, please write: Group Programs, Field Museum.

SPECIAL-INTEREST MEETINGS

Nov. 4, 7:30 p.m. Kennicott Club
Nov. 7, 8:00 p.m. Chicago Anthropological Society
Nov. 9, 2:00 p.m. Chicago Shell Club
Nov. 11, 7:00 p.m. Chicago Nature Camera Club
8:00 p.m. Chicagoland Glider Council
Nov. 12, 7:30 p.m. Windy City Grotto, National Speleological Society
Nov. 13, 8:00 p.m. Chicago Mountaineering Club
Nov. 16, 2:00 p.m. Chicago Shell Club
Nov. 18, 7:30 p.m. Chicago Audubon Society

COMING IN DECEMBER

"19TH CENTURY ALASKAN ESKIMO ART" EXHIBIT. In the language of the Eskimo there is no word for "art" because producing aesthetically beautiful objects from raw materials (caribou antler, driftwood, walrus ivory, and baleen) relates closely to all aspects of Eskimo daily life. Fine examples of 19th and early 20th century Eskimo sculpture, mostly ivory, and traditional graphic designs go on exhibit December 11 in Hall 27.

ESKIMO LIFE AND ART FILM PROGRAM. Three films, "The Eskimo in Life and Legend," "Eskimo Artist Kenojuak," and "Kalvak," will be shown to the public daily at 12:00 noon in the Exhibit Studio, rear of Hall 27.

NOVEMBER HOURS

THE MUSEUM opens daily at 9:00 a.m. and closes at 4:00 p.m. weekdays and 5:00 p.m. weekends. On Friday, year-round, the museum is open to 9:00 p.m. Food service areas are open weekdays 11:00 a.m. to 3:00 p.m., weekends to 4:00 p.m.

THE MUSEUM LIBRARY is open 9:00 a.m. to 4:00 p.m. Monday through Friday. Please obtain pass at reception desk, first floor north.

MUSEUM TELEPHONE: 922-9410

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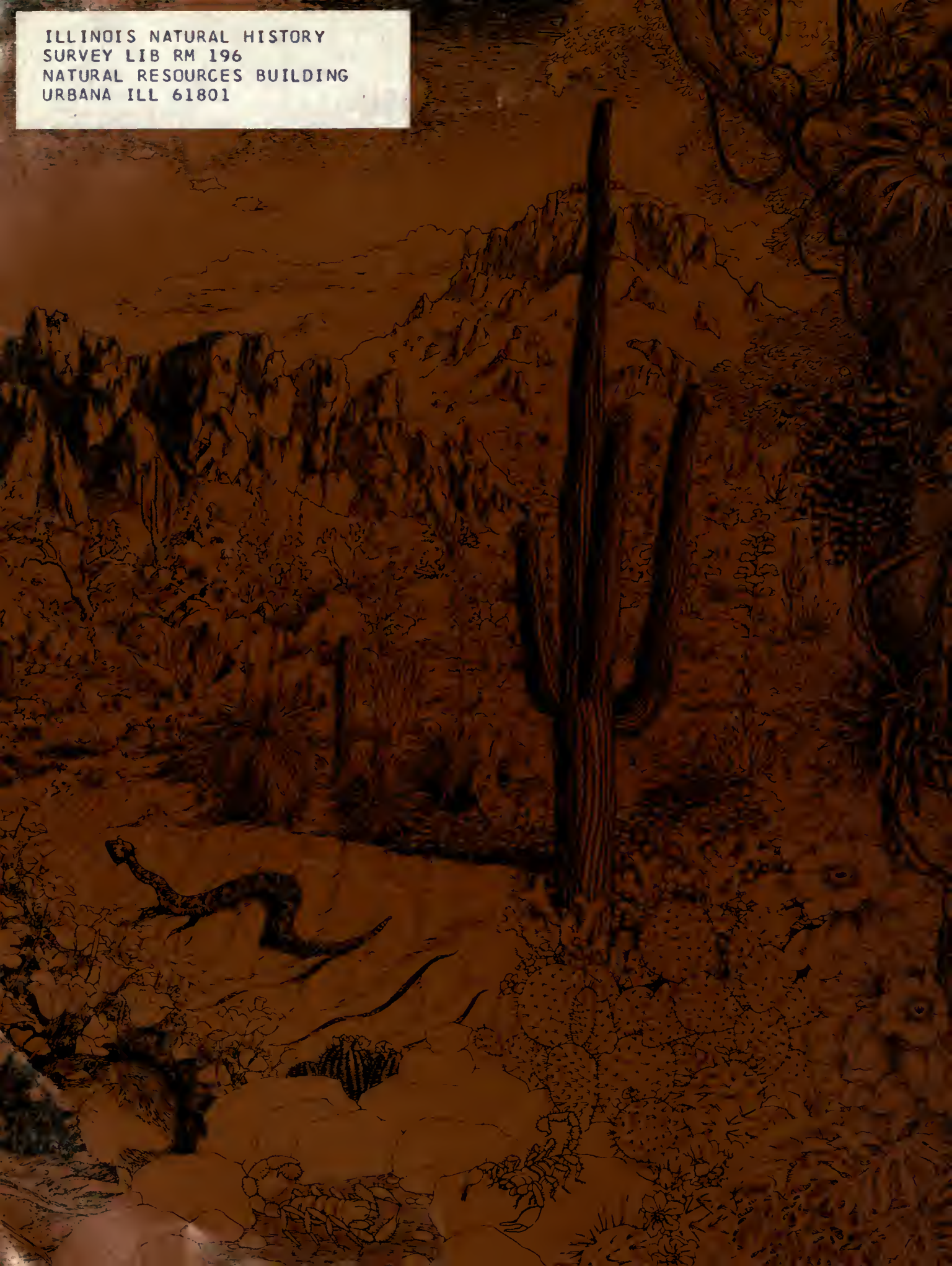

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Wolf mask, probably from St. Michael, Alaska. Used in the Messenger Feast, a socio-religious ceremony in which the residents of one Eskimo village entertain those of another and exchange gifts. Collected in 1897. 24.5 cm high (without feathers). Catalog No. 13433. Photo by Ron Testa, Field Museum photographer. The mask, together with other 19th century Alaskan Eskimo art works, may be seen at Field Museum in a new exhibition opening December 11. See pages 3-7.

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Wooden box in the shape of a whale for harpoon blades. There is an opening on the underside. Length 31 cm.

Nineteenth Century Alaskan Eskimo Art

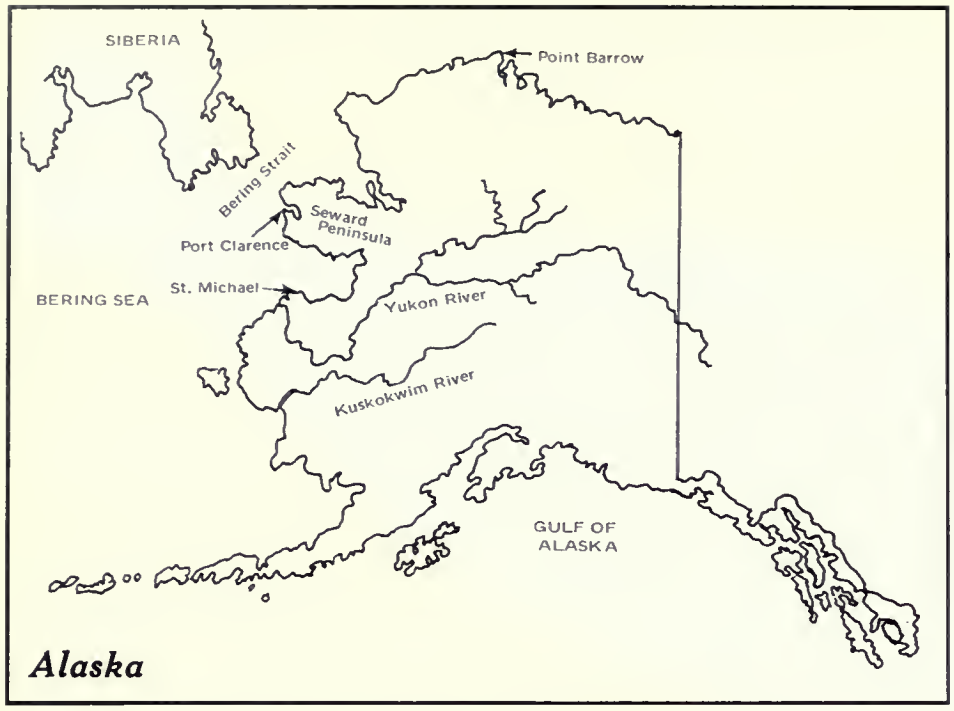
By James W. VanStone

Eskimos for decades have excited curiosity and stimulated the imagination, primarily because of their adaptation to a rigorous and, to residents of southern temperate zones, inhospitable northern environment. Their traditional lands extend for 5,000 miles, from eastern Siberia across Alaska and Canada to Greenland. The total population of less than 50,000 is thinly distributed and generally concentrated along the coasts, for most Eskimos are primarily hunters of sea mammals. The resources of the land, without the bounty of the sea, could support only one-tenth of the total Eskimo population.

Indications are that Eskimo culture may be as much as 5,000 years old, and our knowledge of prehistoric Eskimo art derives from extensive archaeological excavations carried out in recent years throughout the circumpolar regions. Although all Eskimos, according to archaeological evidence, created distinctive art throughout prehistoric times and into the period when they first came in contact with Europeans, the most active artists—those who made the finest sculptures and conceived the most intriguing forms—lived in the western Eskimo area, particularly along the coast of Alaska from the Gulf of Alaska to Point Barrow.

A high point in Eskimo art was achieved by the peoples of the Bering Sea area in the nineteenth and early twentieth centuries. Western civilization came late to the inhabitants of this region and they were thus able to maintain their original way of life up to the last quarter of the nineteenth century, longer than any other Eskimos in Alaska. It is to this area and time period that the exhibition "Nineteenth Century Alaskan Eskimo Art," opening December 11, is devoted — a time when some of the first extensive collections of Eskimo material culture were obtained by the world's museums. The early collectors, often among the first Euro-Americans to visit the Bering Sea Eskimos, frequently did not record the provenience of each specimen collected. Most of the examples of Bering Sea Eskimo art featured in this exhibition were acquired by Field Museum in the 1890s, during the first decade of the institution's existence. All were made by Eskimos living along the vast stretch of coast between Port Clarence and Point Barrow.

James W. VanStone is curator of North American archaeology and ethnology.



Alaska

Although the nature of Eskimo art has been determined to some extent by the materials available to the artists and craftsmen, it is probably accurate to say that the Eskimo artist worked more within the limitations of his tools and the uses of his objects than within the limitations of his materials. Seldom anywhere in the world has art been so intimately related to technology as it was in the Bering Sea area among both prehistoric and historic Eskimos.

The most abundant raw materials available to the Eskimo artist in his environment were caribou antler, driftwood, walrus ivory, and baleen (whalebone). The latter is a pliable, plasticlike substance which hangs in long strips in the mouths of rorquals and right whales. Through these strips, the great animals strain the tiny sea creatures on which they feed. Ivory, in particular, has always been closely associated with Eskimo art, and the majority of objects displayed in the exhibit are fashioned from this material. It is a durable substance but difficult to work even using modern tools. Ivory becomes a lustrous, deep brown color when buried in the ground, and nineteenth century carvers frequently used old walrus tusks recovered from archaeological sites. Since Eskimo carvers and engravers were invariably men, the content of this exhibition is a distinctly male art. Women, however, were expert weavers and skin-sewers, making, in addition to clothing, finely woven grass mats and superbly crafted skin workbags with embroidered decoration.

Metal tools were available to Alaskan Eskimos from the twelfth or thirteenth centuries through trade with Siberian peoples. There is almost certainly a relationship between the eastward spread of metal from Asia to America and the fact that the Eskimos of northwest Alaska have an art style that is technically more refined and complex than that in other Eskimo areas. Much later, beginning in the early 1700s, metal knives and other tools were systematically traded from Russian trading posts in eastern Siberia across Bering Strait to the peoples of northwestern Alaska. Metal tools, particularly saws, adzes, knives, and bow drills, were used by the artists who fashioned the objects in this exhibition.

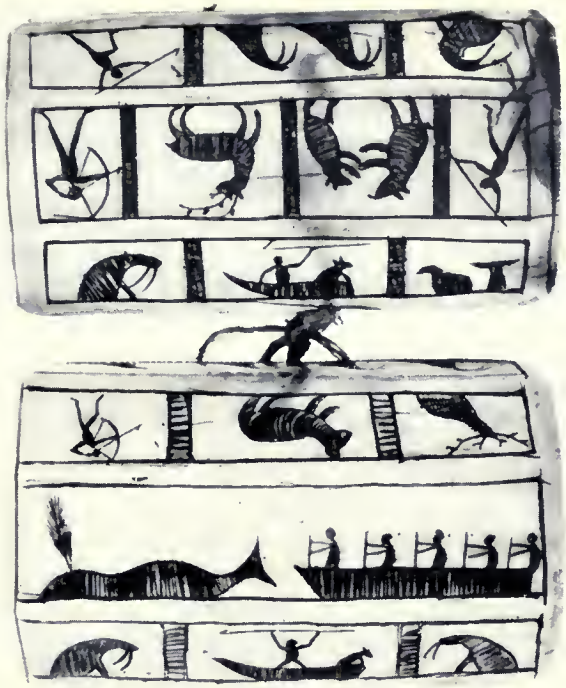
There is no word for art in the Eskimo language; the reason for this is that the manufacture of aesthetically beautiful objects was closely related to all aspects of Eskimo life, particularly religion, ceremonialism, and magic. Most traditional art was religious, and objects which we are likely to consider aesthetically pleasing were made for the very practical purpose of honoring or personifying spirits and deities. This was done in an effort to lessen anxiety toward the unknown universe and to ensure personal and community well-being and safety in a demanding and unpredictable environment.

In aboriginal times, the religious and ceremonial life of the Eskimos of northwestern Alaska centered around the significant supernatural relationship between men and animals. Eskimos considered it important to honor the spirits of game animals that were vital to the economy. People realized that supernatural forces were at work manipulating the basic needs of subsistence as well as life itself, and these supernatural forces needed to be placated and made aware of the wants and needs of human beings. The carvings on hunting implements and other utilitarian objects in this exhibition were fashioned to influence specific animal spirits. Thus, one of the most important aspects of religious art was the necessity of creating an object that was as aesthetically pleasing as possible.

Certainly the Bering Sea Eskimos displayed skill in naturalistic, representational carving unequaled in the arctic and equaled by few other people anywhere in the world at any time.

Although most Eskimo art was religous, some of the animal and bird sculptures in this exhibition were probably carved for no other purpose than to give pleasure to the carver, his friends, and relatives. Other sculptures, however, may have belonged to shamans, the traditional medical and religious practitioners, and thus possessed religious significance as charms or amulets. These forms were usually differentiated by their use. A charm was used to influence hunted animals or to direct destiny in a way provided by the power of the charm. An amulet was a more personal object. It was worn as protection against bad spirits or to bring a certain kind of luck such as good health or love.

Elaborately carved and painted masks were one of the outstanding achievements of Alaskan Eskimo art. The most elaborate ones were made by Eskimos in the area south of St. Michael, particularly along the lower Yukon and



Kuskokwim rivers. Even north of this area, however, fine masks were also made. Those from Seward Peninsula and other areas close to St. Michael have attached appendages in the form of feathers or fur and are likely to be painted. Those further north were unpainted and simpler, but the effect of the representation and the skilled carving is nevertheless impressive.

Eskimo masks not only display technical virtuosity, but give significant insights into religious beliefs and conceptions of the universe. They were used principally in religious ceremonies that honored and propitiated the spirits of game animals and of personal helping spirits to ensure success in hunting; they were also used to ward off evil spirits threatening the individual or community. Masks were usually made by shamans or carvers working under their direction. They were, therefore, the embodiment of a shaman's vision and each mask was different because of the almost infinite variety of visions that a shaman could have. In Eskimo cosmology almost every

Top left: Ivory seal drag handle. The handle is attached to one end of a sealskin line and the other is fastened to the dead animal. The seal can thus be easily dragged back over the ice to the hunter's camp or village. Length: 9 cm. Top right: Ivory box with decoration in the modified engraving style. Length 9 cm. Lower right: Baleen bucket with handle and attachments of ivory. Height 11.4 cm.

Top: Ivory bow drill with decoration in the old engraving style. Length 40.6 cm. Bottom: Walrus tusk with decoration in the western pictorial style. Length 40 cm.

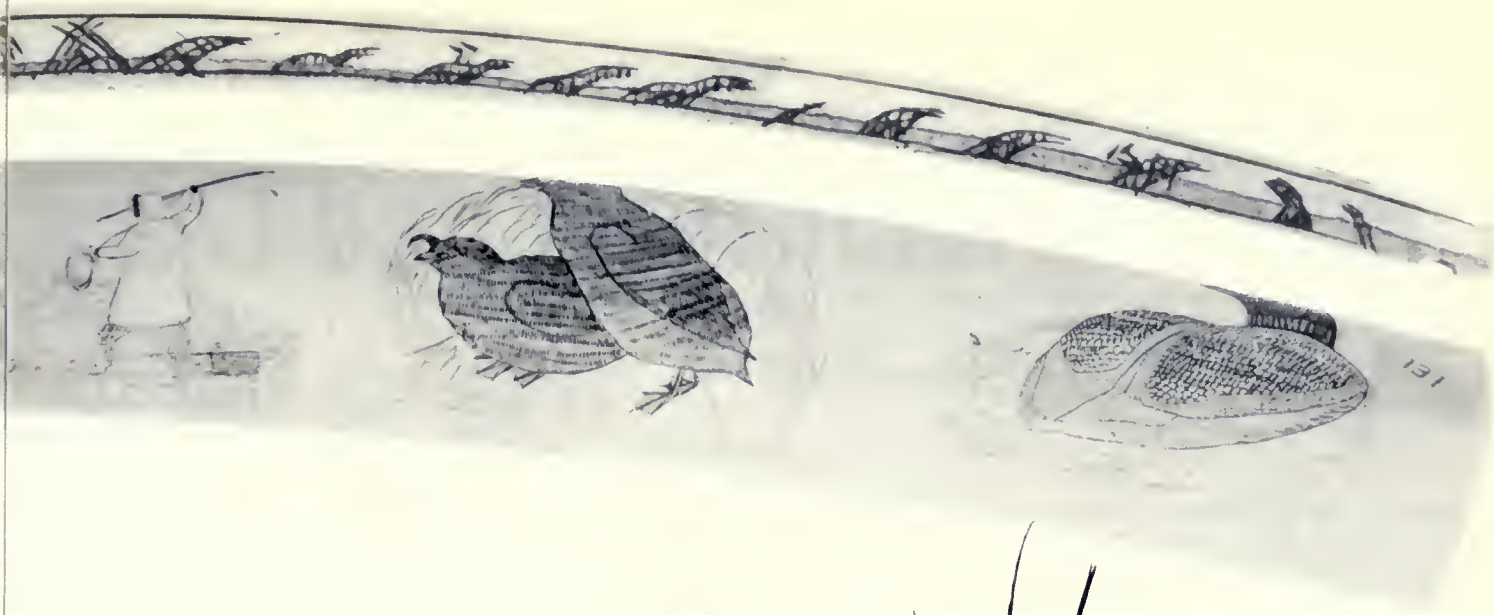
object, animate or inanimate, possessed a spirit. Thus, a blade of grass, a walrus, or a rock could be the subject of all or part of a mask. Also, according to the Eskimo belief system, all animals had the ability to turn into human beings at will. Thus, representation of the human form is common in art, particularly in masks. Also common are animal-human faces which serve to emphasize a duality that is deeply rooted in tradition and folklore. In the making of masks, the range of creative possibilities was virtually limitless.

About 200 years ago a new Eskimo art style began in the Bering Strait area. It consisted of small silhouette engravings on ivory that illustrated every aspect of Eskimo life: men in skin boats harpooning whales, caribou being hunted with bow and arrow, men driving dog teams, hunters creeping up on basking seals, masked men dancing, and many other subjects. With rare economy of line the graphic artist interpreted his knowledge of the human body and the animals and birds around him. This pictorial art, narrowly restricted in its range, was produced only along the coast from Norton Sound to Kotzebue Sound. Although originating in late prehistoric times, it reached its highest development in the second half of the nineteenth century.

Nineteenth and early twentieth century engraving can be divided into three principal styles; these have been called old, modified, and western pictorial engraving. The old engraving style is confined almost entirely to drill bows and bag handles. In this style the artist drew heavily on suggestion for expressing the many variations of human and animal attitudes. As one authority has noted, the artist used a minimum of detail to create a maximum of action. The ivory background, which was never painted, offered a sharp contrast to the black silhouetted figures. The incisions were filled with black ash mixed with oil.

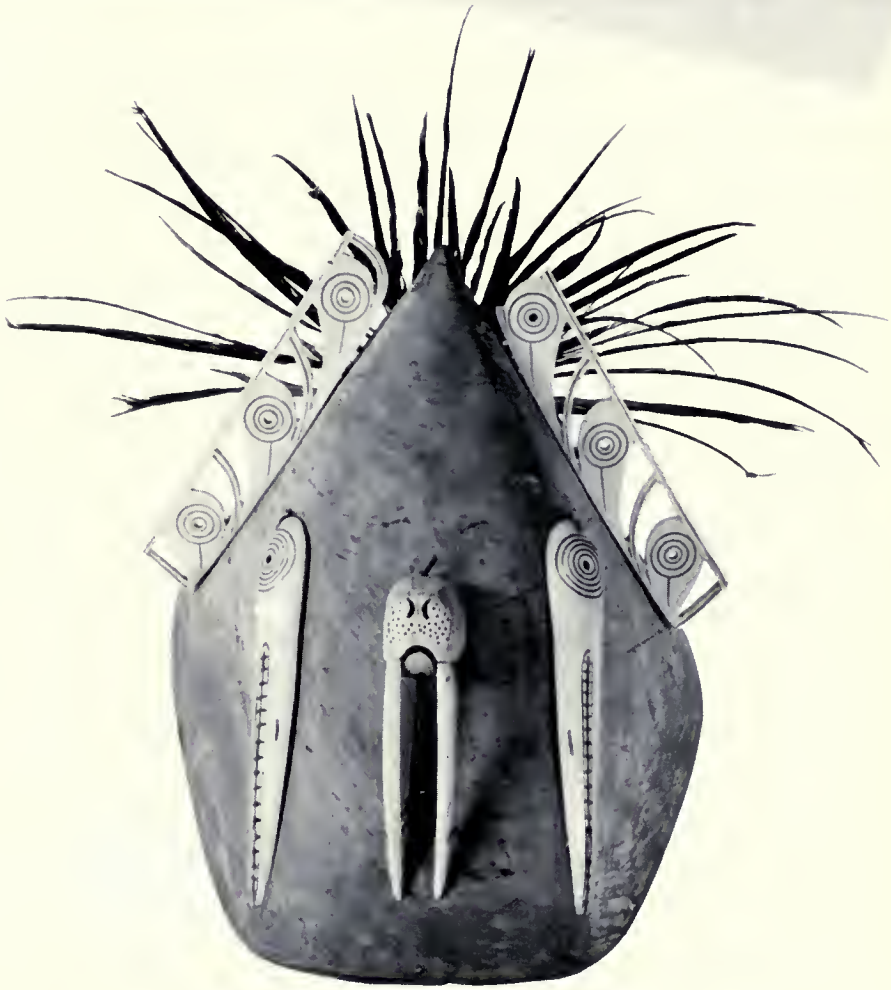
The modified engraving style was used on large ivory pipes and whole walrus tusks that were sold as souvenirs to Euro-Americans who, after 1850, came to Alaska in increasing numbers as gold miners, commercial whalers, and members of exploring and scientific expeditions. Engravers applied essentially the same techniques and subject matter of the smaller surfaces to the larger ones but the human figures were less sticklike, larger, and more rounded out representations of three-masted schooners and Euro-Americans with firearms were added to the subject matter.

In the 1890s the art underwent a more profound change. The western pictorial style was used first on whole walrus tusks and cribbage boards, a form of souvenir that was especially popular from the days of the Yukon and Nome gold rushes in 1898 and 1902 until about 1925. Human and animal figures became fine-line, realistic etchings; sea ice and landscapes were shown in accurate perspective. The western pictorial style, although a legitimate outgrowth of the earlier indigenous styles, was heavily influenced by the whalers' scrimshaw carvings. Some Eskimo artists created real tours de force, utilizing copies of photographs and magazine illustrations along with original subject matter. For the first time, individual artists signed

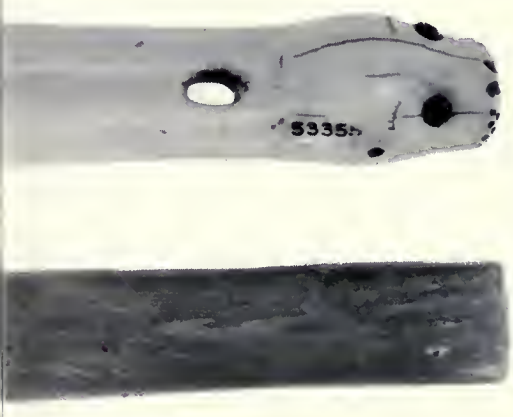


their names to their works. As interest in cribbage boards declined, the western pictorial engraving style was used on a variety of other souvenirs such as napkin rings, letter openers, knife handles, and ivory jewelry.

The first Euro-Americans who came to northwestern Alaska in the nineteenth century purchased, as souvenirs, items of material culture which the Eskimos had made for their own use. As demand increased, the Eskimo carvers went to work to carve items specifically for trade, but their work, for the most part, was devoted to traditionally based sculptures and engravings in ivory. Later, the carvers and engravers were asked to imitate foreign knickknacks; when they made cribbage boards, toothpick holders, gun stock decorations, and fancy handles for canes they were, more often than not, carving things which they had never actually seen. Thus, traditional Eskimo sculptures and engravings are today no longer made within a magical or religious framework. The artists do, however, continue to produce a new art for a wholly commercial market.



Wooden hat with ivory and feather attachments. Worn by a hunter in his kayak. Height 21 cm.



Top: Seal scratcher. A seal's claw is attached to an ivory handle. As the hunter approaches a seal basking on the ice, he scratches the ice with the tool, creating a sound which reassures the wary animal. Length 26.7 cm. Below: Club for killing wounded seals. The head is of bone. Length 40 cm.

SUGGESTED READINGS

Smithsonian Miscellaneous Collections, Vol. LXXXI, No. 14, "Prehistoric Art of the Alaskan Eskimo," by H.B. Collins, 1929.

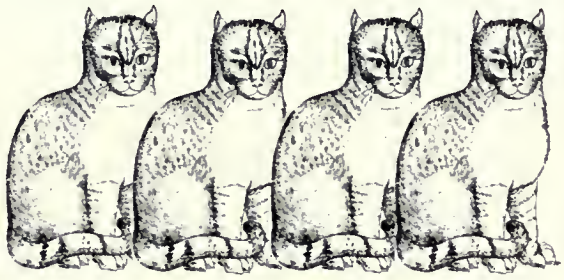
Artists of the Tundra and the Sea, by D.J. Ray, University of Washington Press, 1961.

Eskimo Masks: Art and Ceremony, by D.J. Ray, University of Washington Press, 1967.

U.S. Department of the Interior, Indian Arts and Crafts Board, Native American Arts 2, "Graphic Arts of the Alaskan Eskimo," by D.J. Ray, 1969.

Nyes, Murmurations, and Cetes

And Other Nouns of Assembly



A clowder of cats

English has long been reviled or ridiculed by those who prefer their language neat, clean, and orderly. Vernacular English, declare its harshest critics, often seems a rag bag of bruised syntax, dislocated grammar, and vocabulary that is badly in need of repair. All of which may be true. But even purists must agree that the extraordinary assemblage of words comprising our language is a unique treasure of gems rich in history. And if the patina of modern usage is rubbed away, one can discover facets of meaning and nuance, long disused, vivid with image, inviting to the mind.

A category of such history-laden words—like a drawerful of forgotten specimens—is occasionally pulled into view, scrutinized, and savored by the etymologist or casual word-fancier. But to no purpose; when a word has fallen out of use, no force of man can artificially resurrect it; only certain nether powers, never human design, can restore a word to its former, functional role.

A sampling of such a curious collection—chosen for relevance to natural history—has been tumbled onto these two pages, with no more profound purpose than to offer a chance to savor, contemplate, and possibly cherish them. These "nouns of assembly," or "terms of venery," belong for the most part to the rich past of our language. A few, it will be noted, are still in vogue; even these may date to the time of Chaucer or before.

The earliest known list of nouns of assembly is *The Edgerton Manuscript*, published in England about 1450. In 1476 a more ambitious list, under the title *The Hors, Shepe, & Ghoos*, appeared, with 106 such terms. Probably the best known early compilation is *The Book of St. Albans*, published in 1486; it contained a list of 164. The book's accredited author was one Dame Juliana Barnes. Some historians argue that "Dame Juliana" was in reality several men who chose the collective *nom de plume* for reasons we can only surmise. The selection given here is from a variety of sources, including the above-mentioned, *Farmers Almanac*, and *Illustrated London News*, among others.

BIRDS

A *jubilation* of starlings
A *muster* of peafowl
A *charm* of goldfinches.
A *watch* of nightingales
A *nye* of pheasants
A *paddling* of ducks (at rest)
A *team* of ducks (in flight)
A *fall* of woodcock
A *sege*, or *sedge*, of herons
A *herd* of swans
A *spring* of teal
A *covert* of coots
A *gaggle* of geese (at rest)
A *skein* of geese (in flight)
A *company* of widgeon
A *trip*, or *plump*, of wildfowl
A *rush* of pochard
A *bevy* of quail
A *covey* of partridge or grouse
A *murmuration* of starlings
A *pack* of grouse
A *gathering* of coveys
A *congregation* of plover
A *walk* of snipe (at rest)
A *wisp* of snipe (in flight)
A *building* of rooks
A *tok* of capercaillie
A *band* of jays
A *tidings* of magpies
An *exaltation* of larks
A *pitying* of doves
An *unkindness* of ravens
A *murder* of crows
A *rafter* of turkeys
A *fling* of oxbirds
A *hill* of ruffs
A *convocation* of eagles
A *dropping*, or *dapping*, of sheldrake
A *cast* of hawks
A *main* of blackcock
A *chattering* of choughs
A *sord*, *bord*, or *suit* of mallard

MAMMALS

A *skulk* of foxes
A cete of badgers
A *singular* of boars
A *pride* of lions
A *sleuth*, or *sloth*, of bears
A *gang* of elk
A *herd* of harts
A *bevy* of roes
A *sounder* of pigs
A *rout* of wolves
A *richesse* of martins
A *couple* of rabbits
A *brace*, or *lease*, of bucks, foxes, or hares
A *pace* of asses
A *clowder* of cats
A *kendel* of kittens
A *tribe* of goats
A *mob* of kangaroos
A *harass* of horses
A *lepe* of leopards
A *husk*, or *down*, of hares
A *stud* of mares
A *drove* of oxen
A *troop* of monkeys
A *colony*, *gam*, *pod* or *school* of whales
A *rookery* of seals
A *heft* of sheep (60 to 160)
A *hirsel* of sheep (4 hefts)
A *business* of ferrets
A *crash* of rhinoceros
A *laboring* of moles
A *drey* of squirrels
A *mute* of hart hounds

A singular of boars

There is also a special vocabulary of verbs—most no longer in use—for scaring, or dislodging, animals from cover:

To start, or *move*, a hare
To *rear* a bear
To *raise* a wolf
To *rouse* a buck
To *bolt* a covey
To *find*, or *unkennel*, a fox
to *bag* a marten
To *vent* an otter
To *dig*, or *find*, a badger

And, believe it or not, there were in merrie Englande special terms for the droppings of animals:

Hare: *croteys, crotels, crotishings*
Hart and hind: *fumes, fewmets, fewmishings*
Boar: *freyn, fiants, lesses*
Wolf: *freyn, fiants, lesses, fuants*
Buck: *cotying, fewmets, fewmishings*
Fox: *waggying, billetings, fiants, fuants*
Marten: *dirt, fiants, fuants*
Otter: *spriats, spraints*
Badger: *werdrobe, fiants, fuants*

our environment

Pelican Decline Puzzles Experts

The eastern brown pelican, whose populations took a mysterious nosedive in the 1960s, will receive top priority attention by a team of federal, state, and private bird experts recently appointed by the U.S. Fish and Wildlife Service.

At one time, colonies estimated to total more than 75,000 birds dotted the coastlines of South Carolina, Florida, Louisiana, Texas, and Mexico, nesting on sand bars or coastal islands and feeding on the abundant fish of the shoreline. Pelicans were so numerous along the Gulf Coast of Louisiana that it was named the "Pelican State." In 1960, however, the birds went into a sudden, mysterious decline, virtually vanishing from Louisiana and Texas and becoming severely reduced in South Carolina. The California brown pelican, a separate subspecies, also experienced a disastrous decline in the late 1960s.

Today, in spite of much research and some limited management efforts, the birds continue to be rare throughout their former range, numbering, some scientists estimate, 20,000-25,000. Only in Florida do the birds seem to be successfully breeding and keeping up with their former abundance. The birds disappeared so quickly that the cause of their decline could not be pinpointed. They were gone before most biologists even realized what was happening. It now appears that pesticides, particularly DDT and endrin, were probably the principal culprits, for these chemicals have been shown to be the cause of heavy mortality of adults and young today.

In Louisiana a program was begun in 1968 to transplant birds into the State from the healthy Florida population. It was hoped that this program would either succeed in re-establishing pelicans in the "Pelican State" or else shed more light on the cause of the original dieoff. At first the transplanted birds did well, and 50 to 100 birds were brought in each year. Then this spring many suddenly died. Chemical analysis has revealed lethal levels of endrin in the dead birds' tissues. Endrin, which is heavily used in the cotton belt in the lower Mississippi River drainage, may also have been involved in the original decline.

In South Carolina, on the other hand, the birds did not experience a sudden crash, but rather a slow reduction in numbers and reproductive success which continues today. These birds have thin eggshells and high residues of DDE, a breakdown product of DDT, in their bodies. In many other birds, DDE has been shown to cause reproductive failure by interfering with normal nesting cycles and producing thin-shelled eggs which break easily during incubation. Recently, the DDE levels in South Carolina pelicans have begun to drop, but the birds are not out of danger yet.

It is possible that in some cases, several adverse environmental factors have worked together to produce the decline. Birds already weakened by DDT, endrin, or some other pesticide, for example, might have more difficulty surviving or successfully nesting when faced with food shortages or adverse weather.

Books for Dinosaur Buffs!

The Midwest's most complete selection of dinosaur books for children is to be found at the Field Museum Book Shop. There is something for every age group, as well as for adults, all within a very modest price range.

Prehistoric Monsters Did the Strangest Things ($2.50), by Leonora and Arthur Hornblow, published by Random House, is for the child who has just learned to read and is part of the "Step-up Book" series (the other separate volumes on animals, birds, fish, insects, and reptiles are also carried by the Book Shop). Its 65 brightly illustrated pages also deal with sloths, sabre-tooth tigers, and even cave men.

In the Days of the Dinosaurs ($2.95), by Roy Chapman Andrews—the most famous dinosaur-hunter of all time—is also published by Random House and probably ideal for third- or fourth-graders. Its 82 pages include carefully executed two-color drawings and an illustrated glossary of the better known dinosaurs.

Discovering Dinosaurs ($4.95), by Glenn O. Blough, 48 pages, is published by McGraw-Hill and intended for the same age group as the above. Dr. Blough was formerly a specialist in elementary education with the U.S. Office of Education.

Dinosaurs: Giants of the Past ($1.50), by Eileen Daly and published by the Golden Press, 20 pages. Its large format (9½ x 12½ inches), slick cover, and impressive color drawings of dinosaurs would make it useful for first- and second-graders, but the text is probably best for children two or three years older.

Dinosaurs and Other Prehistoric Reptiles ($3.95), by Jane Werner Watson, also published by Golden Press, is a large format book (12 x 10¾ inches) of 60 pages with excellent four-color artwork, world maps showing dinosaur distribution, and time lines—which show when the various dinosaur species appeared. Best for fourth- and fifth-graders.

Dinosaurs and Other Prehistoric Animals ($3.95), by Darlene Geis, is published by Grosset and Dunlap and has 105 pages of text and artwork. As the title indicates, the book also deals with other prehistoric animals as well as the science of paleontology. Fourth and fifth grade.

Dinosaurs (79c), by Alice Fitch Martin and Bertha Morris Parker, is a paperback book of 48 pages, also published by Golden Press, and is a marvelous buy. It has an evolutionary tree, featured on a two-page spread, that clearly shows the time of emergence and interrelationsips of dinosaurs and other vertebrates. Fourth to sixth grade.

The Dinosaur Book ($5.95), by Edwin H. Colbert, published by McGraw-Hill, has 156 pages of text, drawings and photos suitable for sixth-graders up to the adult level. Dr. Colbert is perhaps the most eminent living paleontologist and was formerly curator of fossil reptiles and amphibians for the American Museum of Natural History.

Days of the Dinosaurs (25c), by Della Cox Weaver, and published by Field Museum, is a 16-page, paperback introduction to dinosaurs that is neither too difficult for fourth-graders nor too elementary for adults.

About Dinosaurs ($1.35), by Margery Morris, is a 48-page paperback booklet published by Penguin. Sixth grade through adult.

The Age of Dinosaurs (paper, $2.95), by Bjorn Kurten, 255 pages, is published by McGraw-Hill and primarily for the high school-through-adult market. Generously illustrated. Dr. Kurten is lecturer in paleontology at the University of Helsinki.

ACTIVITY BOOKS ON DINOSAURS INCLUDE

Dinosaurs (39c), Western Publishing Co., 80 pages; a coloring book.

Dinosaurs Color and Activity Book (69c), Western Publishing Co., 128 pages; some drawings are designed for cutting out.

Tiny Dinosaur Museum Press-Out (59c), Western Publishing Co., 7 pages of precolored press-outs.

The Golden Stamp Book of Animals of the Past (89c), Western Publishing Co., 48 pages plus 4 pages of stamps to be pasted into the line drawings.

Dinosaurs: Prehistoric Wonders of the World (79c), Western Publishing Co., seven pages of colored cut-outs and 12 pages of line drawings.

In addition to books on dinosaurs, the Museum gift shop carries jigsaw puzzles of dinosaurs and three-dimensional models in various sizes, materials, and prices. For $14.25 you can even have a kit for building your own three-foot model of a *Tyrannosaurus rex*, with eyes, teeth, and claws that glow in the dark!

For Christmas, "Give Field Museum"

Whether you are trying to decide on a Christmas gift for the small child or for "the man who has everything," a gift of membership in Field Museum is always appropriate. And for the budget-minded shopper it's one of those unusual finds—a gift that costs no more than it did a few years ago!

For the adult, a membership provides a wealth of opportunities to further explore the realm of natural history; for the child it can open the doors to a lifetime of scientific interest or professional endeavor. Infinitely more than a storehouse of fascinating specimens and exhibits, Field Museum offers to its members at every age level a varied selection of exciting learning experiences via the classroom, workshop, film, or field trip. Perhaps equally important: with a Field Museum membership you are giving a shared relationship, for Field Museum is indeed its members.

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field briefs

Man in His Environment

Staff members who were principally responsible for the new exhibit, *Man in His Environment,* recently gathered for press photographers at the entrance to Hall 18, where the exhibit opened to the public on November 9. From left to right, in the above photo, are Robert F. Inger, assistant director, science and education, and chief spokesman for the exhibit content; Robert S. Kosturak, exhibit designer, Department of Exhibition; E. Leland Webber, director of Field Museum; Paul A. Hummer, project manager; and Glen Cole, curator of prehistory, Department of Anthropology. The striking geodesic structure at the entrance to the exhibit, representing "the sphere of life" (shown behind the group), briefly characterizes earth's major types of environment.

Adult Courses Resume In January

Keep an eye on your mailbox for our ADULT COURSES announcement for Winter 1976. A whole new set of courses in anthropology, geology, and biology will be offered starting January 15, Brochures describing these course offerings are being mailed separately to Museum members. Because class enrollment is limited, many people had to be turned down for our Fall courses. We recommend that you register early.

Bulletin Cover Design Honored

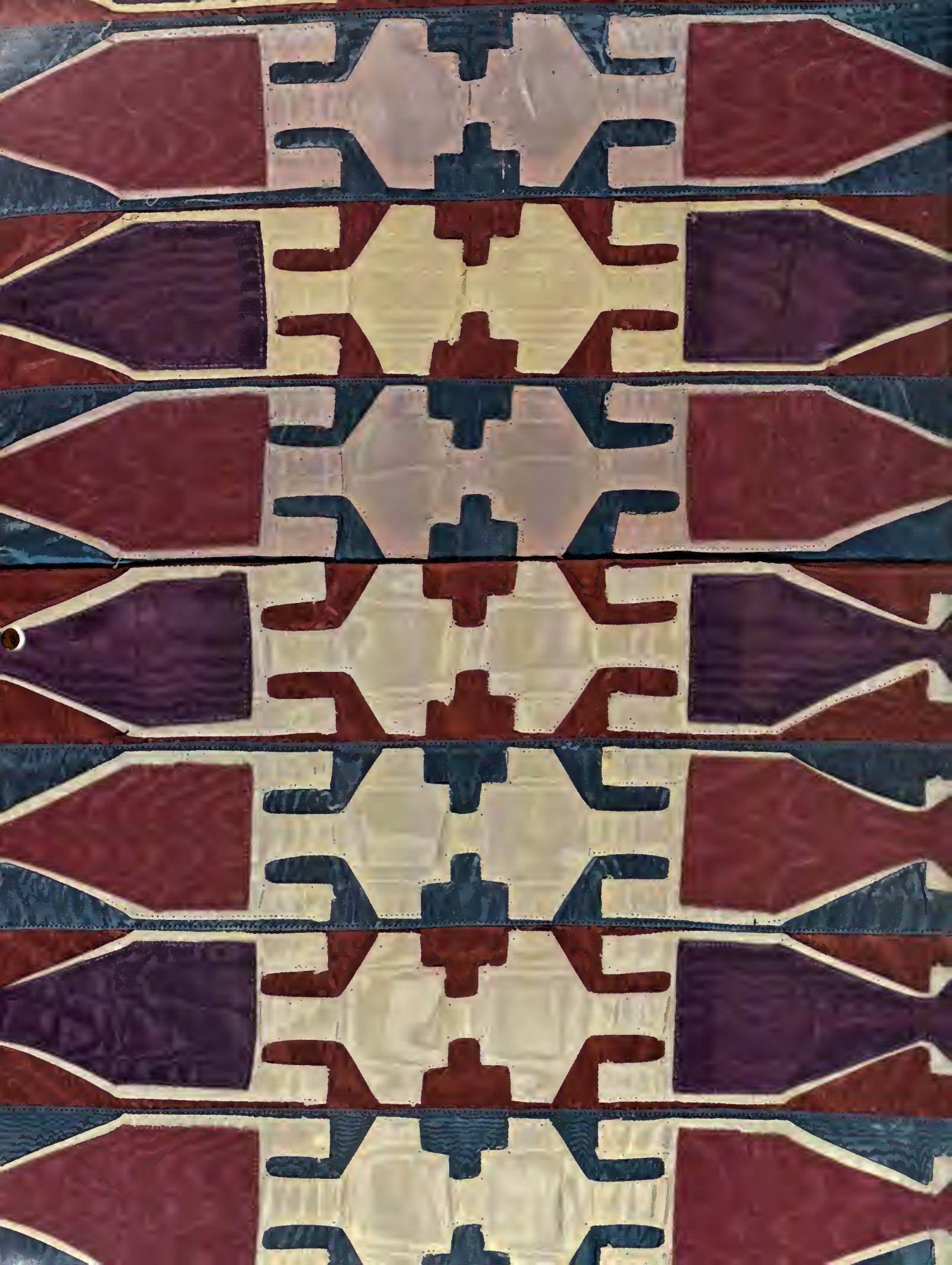
The cover design of the June 1975 *Bulletin* (showing a red-eyed Central American tree frog) was recently honored by the American Institute of Graphic Arts by being selected for its AIGA Cover '75/Catch the Eye show. The remarkable photo was taken by Hy Marx, curator of reptiles and amphibians. The exhibit opened in New York on November 18 and will also be shown throughout the United States and Canada. Copies of the frog photo (8 x 10 color, glossy), suitable for mounting, may be obtained ($4.00 each, postpaid) by writing the editor of the *Field Museum of Natural History Bulletin*.

January 1976

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
MOON PHASES ● New Moon, 1st ◑ First Quarter, 9th ○ Full Moon, 16th ◐ Last Quarter, 23rd ● New Moon, 31st	DECEMBER S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	FEBRUARY S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29	Teachers: Now is the time to sign up for your spring and summer programs	**1** NEW YEAR'S DAY Museum closed	**2** Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**3** Man in His Environment films, 11:00 a.m. and 1:00 p.m.
4 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**5**	**6**	**7**	**8**	**9** Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**10** Man in His Environment films, 11:00 a.m. and 1:00 p.m.
11 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**12**	**13**	**14**	**15** Adult education winter courses begin	**16** Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**17** Man in His Environment films, 11:00 a.m. and 1:00 p.m.
18 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**19**	**20**	**21**	**22**	**23** Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**24** Man in His Environment films, 11:00 a.m. and 1:00 p.m.
25 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**26**	**27**	**28**	**29**	**30** Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**31** Man in His Environment films, 11:00 a.m. and 1:00 p.m.
Eskimo film series at noon, daily through June						Saturday Discovery programs 11:00 a.m. to 3:00 p.m.

Modern ceramic jar from Arizona; Hopi. Diameter 43 cm; height 24 cm. Gift of Warren Gorrell. Photo by Herta Newton. Contemporary Hopi Pottery is often decorated with motifs derived from painted potsherds found at the archaeological site of Sikyatki. This style, with red and black designs on a yellow background, was made by pueblo dwellers of Arizona in the late prehistoric period (A.D. 1300-1500). Its use was revived in 1895 by a woman potter named Nampeyo, a member of the Tewa tribe. Catalog No. 47883.

Field Museum of Natural History



February 1976

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**2**	**3**	**4**	**5**	**6** Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**7** Man in His Environment films, 11:00 a.m. and 1:00 p.m.
8 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**9**	**10**	**11**	**12** LINCOLN'S BIRTHDAY	**13** Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**14** VALENTINE'S DAY. Man in His Environment films, 11:00 a.m. and 1:00 p.m.
15 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**16** PRESIDENTS' DAY*	**17**	**18**	**19**	**20** Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**21** Man in His Environment films, 11:00 a.m. and 1:00 p.m.
22 WASHINGTON'S* BIRTHDAY Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**23**	**24**	**25**	**26**	**27** Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**28** Man in His Environment films, 11:00 a.m. and 1:00 p.m.
29 Man in His Environment films, 11:00 a.m. and 1:00 p.m.				MOON PHASES ◑ First Quarter, 8th ○ Full Moon, 15th ◐ Last Quarter, 22nd ● New Moon, 29th	JANUARY S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	MARCH S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Eskimo film series at noon, daily through June	*The observance of George Washington's birthday as a legal holiday on February 22 began in 1796. In many states, however, his birthday is now celebrated on the third Monday of February designated Presidents' Day.					Saturday Discovery programs 11:00 a.m. to 3:00 p.m.

▲ *Woman's robe* (detail) from Plains area; Osage. Overall length 169.5 cm; width 159.6 cm. Gift of Rene d'Harnoncourt. Around 1800 a unique style of decoration on clothing developed among the tribes of the Great Lakes area and the eastern Plains. Silk ribbons obtained through trade were cut in floral and geometric patterns and applied as borders to skirts, robes, leggings, and moccasins. This work was always done by women. Later, synthetic moire ribbons replaced the imported French silk, and machine stitching came into use, but the fine sense of pattern and color remained; ribbonwork is still being made by the women of some tribes. *Catalog No. 258619.*

Field Museum of Natural History

March 1976

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	1	2 SHROVE TUESDAY	3 ASH WEDNESDAY	4	5 Illustrated lecture—"Focus: People in the Mainstream" 7:30 p.m. Man in His Environment films, 11:00 a.m. and 1:00 p.m.	6 Illustrated lecture—"Focus: People in the Mainstream" 2:30 p.m. Man in His Environment films, 11:00 a.m. and 1:00 p.m.
7 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	8	9	10	11	12 Illustrated lecture—"Focus: People in the Mainstream" 7:30 p.m. Man in His Environment films, 11:00 a.m. and 1:00 p.m.	13 Illustrated lecture—"Focus: People in the Mainstream" 2:30 p.m. Man in His Environment films, 11:00 a.m. and 1:00 p.m.
14 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	15	16	17 ST. PATRICK'S DAY	18	19 Illustrated lecture—"Focus: People in the Mainstream" 7:30 p.m. Man in His Environment films, 11:00 a.m. and 1:00 p.m.	20 Illustrated lecture—"Focus: People in the Mainstream" 2:30 p.m. Man in His Environment films, 11:00 a.m. and 1:00 p.m.
21 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	22	23	24	25	26 Illustrated lecture—"Focus: People in the Mainstream" 7:30 p.m. Man in His Environment films, 11:00 a.m. and 1:00 p.m.	27 Illustrated lecture—"Focus: People in the Mainstream" 2:30 p.m. Man in His Environment films, 11:00 a.m. and 1:00 p.m.
28 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	29	30	31	MOON PHASES ◑ First Quarter, 8th ○ Full Moon, 15th ◐ Last Quarter, 22nd ● New Moon, 30th	FEBRUARY S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29	APRIL S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Eskimo film series at noon daily through June						Saturday Discovery programs 11:00 a.m. to 3:00 p.m.

▲ *Shaman's wooden mask* from southeastern Alaska; Tlingit. Length 29 cm. Collected by Lt. G. T. Emmons prior to 1902. Photo by Herta Newton. Masks were worn on various occasions by peoples on the Northwest Coast; some performances were purely for dramatic entertainment. At other times, masks were worn by shamans, men in close contact with the spirit world, during ceremonies to cure illness. These masks represented spirits which appeared in the shaman's visions. One group of spirits, the *takijek*, look like animals but are really the souls of human beings. *Catalog No. 79254.*

Field Museum of Natural History

April 1976

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
MOON PHASES ◑ First Quarter, 7th ○ Full Moon, 14th ◐ Last Quarter, 21st ● New Moon, 29th	MARCH S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	MAY S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31		**1**	**2** Illustrated lecture—"Focus: People in the Mainstream" 7:30 p.m. Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**3** Illustrated lecture—"Focus: People in the Mainstream" 2:30 p.m. Man in His Environment films, 11:00 a.m. and 1:00 p.m.
4 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**5**	**6**	**7**	**8**	**9** Illustrated lecture—"Focus: People in the Mainstream" 7:30 p.m. Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**10** Illustrated lecture—"Focus: People in the Mainstream" 2:30 p.m. Man in His Environment films, 11:00 a.m. and 1:00 p.m.
11 Man in His Environment films, 11:00 a.m. and 1:00 p.m. PALM SUNDAY	**12**	**13**	**14**	**15** PASSOVER Adult Education Spring courses begin	**16** GOOD FRIDAY Illustrated lecture—"Focus: People in the Mainstream" 7:30 p.m. Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**17** Illustrated lecture—"Focus: People in the Mainstream" 2:30 p.m. Man in His Environment films, 11:00 a.m. and 1:00 p.m.
18 Man in His Environment films, 11:00 a.m. and 1:00 p.m. EASTER	**19**	**20**	**21**	**22**	**23** Illustrated lecture—"Focus: People in the Mainstream" 7:30 p.m. Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**24** Illustrated lecture—"Focus: People in the Mainstream" 2:30 p.m. Man in His Environment films, 11:00 a.m. and 1:00 p.m.
25 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**26**	**27**	**28**	**29**	**30** Illustrated lecture—"Focus: People in the Mainstream" 7:30 p.m. Man in His Environment films, 11:00 a.m. and 1:00 p.m.	
Eskimo film series at noon, daily through June	• Check April "Bulletin" for environmental field trip information					Saturday Discovery programs 11:00 a.m. to 3:00 p.m.

▲ *Box cover from eastern woodlands; probably Ottawa. Diameter 31 cm. Gift of Mrs. A. W. F. Fuller. Photo by Herta Newton. The striking geometric design on this birch bark box cover was executed in dyed porcupine quills. Round boxes were commonly made by the Ottawa and Chippewa; they were used as sewing baskets and were sold commercially. The porcupine quills were inserted through holes in the box. Another layer of bark was used to line the box and conceal the ends of the quills. Catalog No. 258673.*

Field Museum of Natural History

13704

May 1976

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
MOON PHASES ◑ First Quarter, 6th ○ Full Moon, 13th ◐ Last Quarter, 20th ● New Moon, 28th	APRIL S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	JUNE S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30				**1** Man in His Environment films, 11:00 a.m. and 1:00 p.m. Illustrated lecture—"Focus: People in the Mainstream" 2:30 p.m.
2 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**3**	**4**	**5**	**6** MEMBERS' NIGHT	**7** MEMBERS' NIGHT Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**8** Man in His Environment films, 11:00 a.m. and 1:00 p.m.
9 MOTHER'S DAY Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**10**	**11**	**12**	**13**	**14** Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**15** ARMED FORCES DAY Man in His Environment films, 11:00 a.m. and 1:00 p.m.
16 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**17**	**18**	**19**	**20**	**21** Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**22** Man in His Environment films, 11:00 a.m. and 1:00 p.m.
23 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**24**	**25**	**26**	**27**	**28** Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**29** Man in His Environment films, 11:00 a.m. and 1:00 p.m.
30 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**31** MEMORIAL DAY	Eskimo film series at noon, daily through June				Saturday Discovery programs 11:00 a.m. to 3:00 p.m.

▲ *Top:* ivory pipe from northwest Alaska; Eskimo. Length 29.5 cm. Gift of E. E. Ayer. (*Catalog No. 13794.*) *Bottom:* Ivory pipe from Port Clarence, Alaska; Eskimo. Length: 30.5 cm. (*No catalog number.*) These ivory pipes were made by the Eskimo in the 19th century for sale to the men of visiting whaling ships. They are decorated with carvings in relief and incised designs. The main decorative themes include animals, hunting scenes, events in village life, and the big whaling ships.

Field Museum of Natural History

June 1976

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		1	2	3	4 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	5 Man in His Environment films, 11:00 a.m. and 1:00 p.m.
6 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	7	8	9	10	11 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	12 Man in His Environment films, 11:00 a.m. and 1:00 p.m.
13 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	14 FLAG DAY	15	16	17	18 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	19 Man in His Environment films, 11:00 a.m. and 1:00 p.m.
20 FATHER'S DAY Man in His Environment films, 11:00 a.m. and 1:00 p.m.	21	22	23	24	25 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	26 Man in His Environment films, 11:00 a.m. and 1:00 p.m.
27 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	28	29	30	MOON PHASES ◑ First Quarter, 5th ○ Full Moon, 11th ◐ Last Quarter, 19th ● New Moon, 27th	MAY S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	JULY S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Eskimo film series at noon, daily through June						Saturday Discovery programs 11:00 a.m. to 3:00 p.m.

▲ *Bag* (detail) from Nebraska; Winnebago. Overall length 34 cm; width 24 cm. Collected by Frederick Starr prior to 1905. Photo by Herta Newton. Twined bags were originally made by women of the woodlands and prairies from vegetable fibres, colored with natural dyes. The same technique was later used with brightly colored woolen yarns acquired from trade. The details of the pattern are often different on the two sides of the flat bag; this detail is from a piece using several animal motifs. *Catalog No. 92075.*

Field Museum of Natural History

July 1976

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
MOON PHASES ◑ First Quarter, 4th ○ Full Moon, 11th ◐ Last Quarter, 19th ● New Moon, 26th	JUNE S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	AUGUST S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31		1	2 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	3 Man in His Environment films, 11:00 a.m. and 1:00 p.m.
4 INDEPENDENCE DAY Man in His Environment films, 11:00 a.m. and 1:00 p.m.	5	6	7	8	9 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	10 Man in His Environment films, 11:00 a.m. and 1:00 p.m.
11 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	12	13	14	15	16 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	17 Man in His Environment films, 11:00 a.m. and 1:00 p.m.
18 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	19	20	21	22	23 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	24 Man in His Environment films, 11:00 a.m. and 1:00 p.m.
25 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	26	27	28	29	30 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	31 Man in His Environment films, 11:00 a.m. and 1:00 p.m.
						Saturday Discovery programs 11:00 a.m. to 3:00 p.m.

▲ *Buckskin charms;* Sioux. Lengths (l. to r.) 16 cm, 13 cm, 23 cm. Gifts of E. E. Ayer; collected prior to 1894. Photo by Herta Newton. It was customary among various Plains peoples to fashion quilled or beaded charms in the shape of a turtle or a lizard. These animals were believed to live long and healthy lives, and it was hoped that this good fortune would be imparted to a newborn child by placing his umbilical cord inside the charm. *Catalog Nos. 15967, 15961, 15963.*

Field Museum of Natural History

August 1976

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**2**	**3**	**4**	**5**	**6** Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**7** Man in His Environment films, 11:00 a.m. and 1:00 p.m.
8 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**9**	**10**	**11**	**12**	**13** Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**14** Man in His Environment films, 11:00 a.m. and 1:00 p.m.
15 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**16**	**17**	**18**	**19**	**20** Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**21** Man in His Environment films, 11:00 a.m. and 1:00 p.m.
22 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**23**	**24**	**25**	**26**	**27** Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**28** Man in His Environment films, 11:00 a.m. and 1:00 p.m.
29 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**30**	**31**		MOON PHASES ◑ First Quarter, 2nd ○ Full Moon, 9th ◐ Last Quarter, 17th ● New Moon, 25th ◑ First Quarter, 31st	JULY S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	SEPTEMBER S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Teachers: Now is the time to sign up for your fall and winter programs						Saturday Discovery programs 11:00 a.m. to 3:00 p.m.

▲ *Bandolier bag* (detail) from Great Lakes area; Pottawatomi or Chippewa. Overall width 31 cm; length 102 cm. Gift of Miss Teresa Drake. Photo by Herta Newton. This woven beadwork uses a leaf pattern common in the Great Lakes area. It is a detail of the pouch decoration on a man's bandolier, or shoulder bag. Other sections of the bag have curvilinear floral designs and a variety of geometric patterns, yet the overall effect is aesthetically harmonious. This bag was collected prior to 1900. *Catalog No. 206355.*

Field Museum of Natural History

September 1976

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
MOON PHASES ○ Full Moon, 8th ◐ Last Quarter, 16th ● New Moon, 23rd ◑ First Quarter, 30th	AUGUST S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	OCTOBER S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	**1**	**2**	**3** Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**4** Man in His Environment films, 11:00 a.m. and 1:00 p.m.
5 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**6** LABOR DAY	**7**	**8**	**9**	**10** Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**11** Man in His Environment films, 11:00 a.m. and 1:00 p.m.
12 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**13**	**14**	**15**	**16**	**17** Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**18** Man in His Environment films, 11:00 a.m. and 1:00 p.m.
19 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**20**	**21**	**22**	**23**	**24** Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**25** ROSH HASHANA Man in His Environment films, 11:00 a.m. and 1:00 p.m.
26 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**27**	**28**	**29**	**30**		
						Saturday Discovery programs 11:00 a.m. to 3:00 p.m.

▲ *Pouch* from eastern woodlands; Iroquois. Length 30 cm; width 23.5 cm. Gift of Mrs. A. W. F. Fuller. This pouch was collected during the 18th century by Field Marshal Jeffrey Baron Amherst while serving as governor general of North America (1758-1763). Black was a popular color for leather in the woodlands, as it provided a good background for the colorful decorative work. The main design on this pouch, two thunderbirds, is executed in porcupine quillwork; decorative trimmings include brass tinkling cones and dyed deer hair. *Catalog No. 155563.*

Field Museum
of
Natural History

October 1976

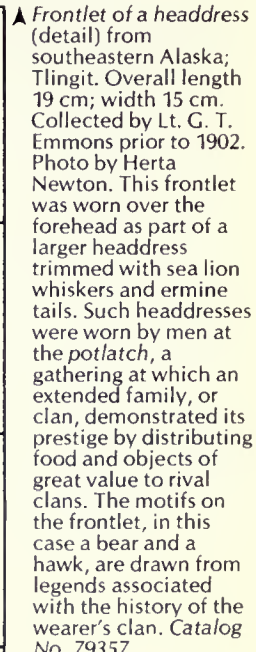
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
MOON PHASES ○ Full Moon, 7th ◐ Last Quarter, 16th ● New Moon, 22nd ◑ First Quarter, 29th	SEPTEMBER S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	NOVEMBER S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30			**1** Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**2** Film lecture Grand opening of James Simpson Theater Man in His Environment films, 11:00 a.m. and 1:00 p.m.
3 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**4** YOM KIPPUR	**5**	**6**	**7**	**8** Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**9** Film lecture Man in His Environment films, 11:00 a.m. and 1:00 p.m.
10 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**11** COLUMBUS DAY	**12**	**13**	**14** Adult Education Fall courses begin	**15** Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**16** Film lecture Man in His Environment films, 11:00 a.m. and 1:00 p.m.
17 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**18**	**19**	**20**	**21**	**22** Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**23** Film lecture Man in His Environment films, 11:00 a.m. and 1:00 p.m.
24 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**25** VETERANS' DAY	**26**	**27**	**28**	**29** Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**30** Film lecture Man in His Environment films, 11:00 a.m. and 1:00 p.m.
31 HALLOWEEN Man in His Environment films, 11:00 a.m. and 1:00 p.m.						Saturday Discovery programs 11:00 a.m. to 3:00 p.m.

▲ *Painting on unbleached muslin* (detail) from Fort Peck Reserve, Montana; Dakota Sioux or Assiniboine. Overall length 180 cm; width 91 cm. Gift of Mrs. Alice Hall Gregory. Photo by Herta Newton. Paintings in a realistic, figurative style were made by Plains men; originally done on buffalo skins and hung in tipis to illustrate the owner's achievements. The demise of the nomadic life saw the Plains groups settled in wood frame houses on the reserves; paintings were still hung in the houses, but they were created on muslin trade cloth rather than on buffalo skins. This scene is from a large painting executed around 1890. *Catalog No. 12639.*

Field Museum of Natural History

November 1976

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	1	2 ELECTION DAY	3	4	5 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	6 Film lecture Man in His Environment films, 11:00 a.m. and 1:00 p.m.
7 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	8	9	10	11	12 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	13 Film lecture Man in His Environment films, 11:00 a.m. and 1:00 p.m.
14 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	15	16	17	18	19 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	20 Film lecture Man in His Environment films, 11:00 a.m. and 1:00 p.m.
21 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	22	23	24	25 THANKSGIVING	26 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	27 Film lecture Man in His Environment films, 11:00 a.m. and 1:00 p.m.
28 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	29	30		MOON PHASES. ○ Full Moon, 6th ◐ Last Quarter, 14th ● New Moon, 21st ◑ First Quarter, 28th	OCTOBER S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	DECEMBER S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
						Saturday Discovery programs 11:00 a.m. to 3:00 p.m.



Frontlet of a headdress (detail) from southeastern Alaska; Tlingit. Overall length 19 cm; width 15 cm. Collected by Lt. G. T. Emmons prior to 1902. Photo by Herta Newton. This frontlet was worn over the forehead as part of a larger headdress trimmed with sea lion whiskers and ermine tails. Such headdresses were worn by men at the *potlatch*, a gathering at which an extended family, or clan, demonstrated its prestige by distributing food and objects of great value to rival clans. The motifs on the frontlet, in this case a bear and a hawk, are drawn from legends associated with the history of the wearer's clan. *Catalog No. 79357.*

Field Museum of Natural History

December 1976

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
MOON PHASES ○ Full Moon, 6th ◐ Last Quarter, 14th ● New Moon, 20th ◑ First Quarter, 28th	NOVEMBER S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	JANUARY S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	**1**	**2**	**3** Man in His Environment films, 11:00 a.m. and 1:00 p.m. ILLINOIS ENTERED UNION, 1818	**4** Man in His Environment films, 11:00 a.m. and 1:00 p.m.
5 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**6**	**7**	**8**	**9**	**10** Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**11** Man in His Environment films, 11:00 a.m. and 1:00 p.m.
12 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**13**	**14**	**15**	**16**	**17** Man in His Environment films, 11:00 a.m. and 1:00 p.m. FIRST DAY OF HANUKKAH	**18** Man in His Environment films, 11:00 a.m. and 1:00 p.m.
19 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**20**	**21**	**22**	**23**	**24** Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**25** CHRISTMAS DAY Museum closed
26 Man in His Environment films, 11:00 a.m. and 1:00 p.m.	**27**	**28**	**29**	**30**	**31** Man in His Environment films, 11:00 a.m. and 1:00 p.m.	
						Saturday Discovery programs 11:00 a.m. to 3:00 p.m.

▲ *Ceremonial basket* from Sonoma County, California; Wappo. Diameter 27 cm; height 16 cm. Gift of Homer E. Sargent. Photo by Herta Newton. The native peoples of California are noted for their fine basketry. Some unusual materials are incorporated in their work, including feathers, shell beads, and woolen yarns and glass beads obtained commercially. The trade beads forming the design here were woven directly into the coils while the basket was being constructed. It was made some time before 1904. *Catalog No. 103191.*

Field Museum of Natural History

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DECEMBER at Field Museum

NEW PROGRAMS AND EXHIBITS

ESKIMO ART EXHIBIT

"19TH CENTURY ALASKAN ESKIMO ART" EXHIBIT opens December 11. In the language of the Eskimo there is no word for "art" because producing aesthetically beautiful objects from raw materials (caribou antler, driftwood, walrus ivory, and baleen) relates closely to all aspects of Eskimo daily life. Fine examples of 19th and early 20th century Eskimo tools, weapons, household and other items of everyday use (many with engraved designs) will be exhibited in Hall 27, through June 30, 1976. A don't miss.

ESKIMO FILM SERIES

ESKIMO ART AND ARTISTS are illustrated in three films. The series begins December 11. All films are shown daily at 12:00 noon in the Exhibit Studio at the rear of Hall 27, through June 30.

Eskimo in Life and Legend (23 min.) The story of a great hunter who carved the image of his wish from a chosen piece of stone—and saw the wish come true.

Eskimo Artist Kenojuak (19 min.) Kenojuak, artist, wife, and mother, makes her drawings when she is free of the duties of trail or camp. Her thoughts are spoken as commentary for the film and add to our understanding of the images she creates.

Kalvak (20 min.) As a child, Kalvak, now a sixty-eight-year-old Eskimo woman, travelled on many long hunting trips with her parents. She uses the subjects of these experiences which give her beautiful, sensitive drawings a strong environmental emphasis.

CONTINUING PROGRAMS AND EXHIBITS

BICENTENNIAL EXHIBIT

MAN IN HIS ENVIRONMENT, a major new permanent exhibit in a major new exhibition hall. This dramatic, 8,000-square-foot exhibition (2 movie theatres plus several areas of three-dimensional displays) explores nature's magnificent system of checks and balances and man's dependence on this system. The exhibit also deals with man's activities and their effects on the quality of life on our planet, and asks visitors to consider the implication for earth's future.

ENVIRONMENTAL FILM SERIES

ENVIRONMENT: THE SUM OF ITS PARTS, offered now through spring 1976. The December series, "Adaptations for Survival," illustrates special adaptations of flora and fauna, and their relationships to each other and to the environment. Films are shown at 11:00 a.m. and 1:00 p.m. in the Meeting Room, second floor north.

Dec. 5, 6, 7: *Baobab: Portrait of a Tree* (53 min.)
Dec. 12, 13, 14: *Hunters in the Reef* (25 min.)
Dec. 19, 20, 21: *Strange Creatures of the Night* (52 min.)
Dec. 26, 27, 28: *Bird's Paradise: The Waddensea* (27 min.)

SATURDAY DISCOVERY PROGRAMS

TOURS, DEMONSTRATIONS, AND PARTICIPATORY ACTIVITIES are offered continuously, every Saturday, 11:00 a.m. to 3:00 p.m. Topics vary, but often include: DINOSAURS—clay modeling in the Hall of Dinosaurs; make one to take home. EARLY MAN—a tour that traces man's physical and cultural evolution. NATIVE AMERICAN FOODS—free samples of food from Hopi, Navajo, and Zuni peoples plus free recipes. ANCIENT EGYPT—half-hour tour of our Egyptian collection includes an explanation of the "how's" and "why's" of mummy-making THE WORLD OF ANIMALS—touchable specimens on display; learn how they're prepared for exhibits.

For specific programs and locations, inquire at entrances.

WINTER JOURNEY FOR CHILDREN

"NOMADS OF THE MYSTIC MOUNTAINS," a free self-guided tour through the museum's colorful Tibet exhibit. All children who can read and write are invited to participate. Journey sheets in English and Spanish are available at the information booth. Bring pen or pencil.

WEAVING DEMONSTRATIONS

THE ANCIENT ART OF WEAVING on a two-harness, handcrafted Mexican floor loom, demonstrated by members of the North Shore Weavers' Guild every Monday, Wednesday, and Friday, 10:30-11:30 a.m. and 12:00-1:00 p.m., through December 12. On Monday, December 1, the demonstration includes spinning. South Lounge, second floor.

SPECIAL-INTEREST MEETINGS

Dec. 2, 7:30 p.m. **Kennicott Club**
Dec. 5, 8:00 p.m. **Chicago Anthropological Society**
Dec. 9, 7:00 p.m. **Chicago Nature Camera Club**
8:00 p.m. **Chicagoland Glider Council**
Dec. 10, 7:30 p.m. **Windy City Grotto, National Speleological Society**
Dec. 11, 8:00 p.m. **Chicago Mountaineering Club**
Dec. 16, 7:30 p.m. **Chicago Audubon Society**

DECEMBER HOURS

THE MUSEUM opens daily at 9:00 a.m. and closes at 4:00 p.m. weekdays and 5:00 p.m. weekends. On Friday, year-round, the museum is open to 9:00 p.m. Food service areas are open weekdays 11:00 a.m. to 3:00 p.m, weekends to 4:00 p.m.

THE MUSEUM LIBRARY is open 9:00 a.m. to 4:00 p.m. Monday through Friday. Please obtain pass at reception desk, first floor north.

MUSEUM TELEPHONE: 922-9410

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